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REMEDIAL INVESTIGATION/ FEASIBILITY STUDY QUALITY ASSURANCE PROJECT PLAN LENZ OIL SERVICE, INC. LEMONT, ILLINOIS

REVISION: 3

SUBMITTED BY:

LENZ OIL SETTLING RESPONDENTS

NOVEMBER 12, 1990

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ERM PROJECT NO. 9292

LENZ OIL SITE, LEMONT, ILLINOIS
RI/FS QUALITY ASSURANCE PROJECT PLAN

~~OCTOBER 19, 1990~~ November 12, 1990

REVISION: ~~2~~ 3

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LENZ OIL SITE
LEMONT, ILLINOIS
AMENDMENT TO THE RI/FS
QUALITY ASSURANCE PROJECT PLAN
DECEMBER 18, 1990
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1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, Quality Assurance (QA), and Quality Control (QC) activities designed to achieve the specific data quality objectives associated with the Remedial Investigation at the Lenz Oil Site. The plan has been prepared in accordance with the U.S. Environmental Protection Agency (USEPA) document "Content Requirements for Quality Assurance Plans" prepared by Dr. Cheng-Wen Tsai of USEPA Region V with supplemental references from another Region V document "Final Standard QAPP Content Document" (June 1989). The QAPP is a companion document to the Sampling and Analysis Plan (SAP), and describes the measures taken to ensure that the data resulting from the sampling activities meet the desired quality objectives.

The general objectives of the Remedial Investigation (RI) at the Lenz Oil Site are to confirm the nature and extent of ground water, soil, surface water, and sediment contamination at the Lenz Oil Site.

In response to these objectives, the Lenz Oil Site Remedial Investigation is designed to collect the required data. The scope of the investigation will minimize the collection of unnecessary data and maximize the data quality.

Initial investigative activities will include collecting and reviewing pertinent background data to identify the precise locations for the data collection activities. Additionally, the

following activities will be performed to provide an indication of the nature and extent of contamination:

- Monitoring wells will be installed on and near the site,
- Surface water bodies will be sampled,
- Sediment samples will be collected from the surface water bodies, and
- Soil samples will be collected both on and off site.

1.1 Site Description and History

The RI/FS Work Plan (WP) contains a detailed description of the Lenz Oil Site and its background in Sections 2.1 and 2.2. The site's geology and hydrogeology are discussed in the WP Sections 2.4 and 2.5, respectively. Both the Consent Order, with an effective date of November 23, 1989, and Sections 2.3 and 3.0 of the WP discuss the site's history.

1.2 Target Compounds

Soil, sediment, and water matrices will be analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. Tentatively Identified Compounds (TICs) will be included in the CLP RAS SOW volatile and semivolatile analyses. Ground water samples will be analyzed for both total metals and dissolved metals; however, surface water samples will be analyzed for total metals, but not dissolved metals. Table 1-1 lists the

TCL organic and TAL inorganic target parameters and their associated contract required detection limits for soil/sediment and water samples. Selected soil samples will also be analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals. The TCLP target parameters for this project and their associated project-required detection limits are presented on Table 1-2.

Soil gas will be analyzed for 1,2-dichloroethane, 1,2-dichloroethene, trichloroethene, 1,1,1-trichloroethane, toluene, and xylene. TAL inorganics, and EP Toxicity Metals. The soil gas target parameters, their associated project-required detection limits, and the estimated method detection limits are presented on Table 1-3. The project-required detection limits for soil gas were determined by converting the CLP detection limits for ground water to soil gas detection limits using Henry's Law Constant and a conversion factor for calculating parts per million by volume (ppmV) from mg/m^3. The methodology and rationale for determining the project-required detection limits for soil gas are presented in Appendix A.

Other field and laboratory data targeted for collection include the following:

- Qualitative and semiquantitative HNu screening data for total volatile organic compound concentrations in soil, sediment, soil gas, and ground water;

- Qualitative descriptions of the soil, sediment, bedrock, surface water, and ground water samples;

- The pH, specific conductivity, and temperature of surface water and ground water samples;

- Water level measurements and hydraulic conductivity values for the shallow aquifer; and

- The particle size distribution, total porosity, and total organic carbon content of geotechnical soil samples.

Soil samples will be classified according to the Unified Soil Classification System; the other samples will be described using standard descriptive terminology.

1.3 Project Objectives

1.3.1 Specific Objectives

The specific objectives of this RI are as follows:

- Determining the current nature (types and levels) and extent of ground water, surface water, soil, and sediment contamination; and

- Identifying remedial alternatives for the site.

1.3.2 Intended Data Uses

The data uses for the analyses to be conducted during the RI are:

- Field ambient air volatile organics - used to determine the level of respiratory protection required during work activities at the site.
- Field soil gas data - used to locate the monitoring wells.
- Laboratory analyses of ground water, surface water, soils, and sediments - used to identify the current nature and extent of contamination at the site so that remediation requirements can be established.
- Field measurements of ground water, pH, conductivity, and temperature - used to ensure proper well development.
- Field soil classification and bedrock descriptions - used to interpret site geology.
- Total porosity, particle size analysis, total organic carbon, water level, and hydraulic conductivity data - used to interpret site hydrogeology and contaminant migration in ground water.

- Semiquantitative field volatile organic screening of on-site soil and soil gas samples - used to select soil samples, and to evaluate the soil gas sampling area for sufficiency.

- Field sediment, surface water, and ground water descriptions - used to further characterize the site.

- Qualitative field volatile organic screening of sediment, bedrock, and off-site surface soil - used to determine the level of personnel protection required during work activities and to assist in selecting well screen intervals.

1.3.3 Data Quality Objectives

To achieve the project objectives, Data Quality Objectives have been established to ensure that the data collected are sufficient and of adequate quality for their intended uses. Additionally, the EPA guidance manual, Data Quality Objectives For Remedial Activities (EPA/540/G-87/003, March, 1987), identifies five general analytical support levels according to the type of technology and degree of sophistication. Briefly, these levels are as follows:

- Level I: Field screening using portable instruments.

- Level II: Field analysis using portable analytical instruments.

- Level III: Non-CLP RAS laboratory analysis.
- Level IV: CLP RAS.
- Level V: Nonstandard methods including CLP.

Based on the intended uses, described in Section 1.3.2, the available instrumentation, and the desired level of certainty, the following analytical levels have been selected.

- Field ambient air volatile organics - Level I.
- Laboratory analyses of soil gas - Level II.
- CLP RAS organic and inorganic laboratory analyses of soil and water - Level IV.
- Field pH, conductivity, and temperature - Level I.
- Field soil and bedrock classification - Not Applicable.
- Total porosity, particle size, and total organic carbon analyses of soil - Level III.
- Field water level and hydraulic conductivity measurements - Level II.
- Semiquantitative field volatile organic screening of on-site soil and soil gas - Level I.

- Qualitative field volatile organic screening of off-site soil, sediment, and bedrock - Level I.
- TCLP metals extraction of soil - Level III.
- Laboratory analyses of TCLP metals extract - Level IV.

The use of the foregoing analytical support levels will assure achievement of both the overall and specific project objectives established for the Lenz Oil Site RI.

1.4 Sample Network and Rationale

The sample network and rationale is presented in the Sampling and Analysis Plan (SAP). Section 3.0 of the SAP describes the sampling locations and frequency for the matrices. Specific sampling locations are shown on figures in the SAP as follows: Figure 3-1 for ground water, Figure 3-2 for on-site soil, Figure 3-3 for off-site soil and sediment, Figure 3-4 for surface water, and Figure 3-5 for soil gas sampling. Tables 3-1 and 3-2 in the SAP are summaries of the source characterization and site characterization analysis plans and include matrices, parameters, and frequency of collections.

1.5 Project Schedule

The project schedule is presented in Section 7.0 of the RI/FS Work Plan. Work progress reports will be prepared and submitted to the USEPA during the course of the project on the schedule specified in the Administrative Consent Order.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Common Counsel for the Lenz Oil Setting Respondents (Table 2-1) will have the overall responsibility for all phases of the RI/FS. ERM-North Central, Inc. (ERM) will report to the Common Counsel and will be responsible for execution of the work for which it is contracted. The organizational chart for implementation of the RI/FS is shown in Figure 2-1.

Although the IEPA does have review responsibilities for work conducted by ERM-North Central for the Respondents, because of a contractual agreement between IEPA and the Respondents, the IEPA will function as a subcontractor to ERM-North Central with respect to this QAPP. Specifically, the IEPA will follow and abide by the requirements of this QAPP for the conduct of their investigation and reporting of the drainage ditch and on-site soil sampling program. However, the IEPA will provide their own QA Officer (QAO) to enforce this QAPP in the performance of the IEPA site investigation and reporting. The data acquired by IEPA will be provided to ERM-North Central for incorporation into the required Respondent reports and for inclusion in the project's evidence file.

The IEPA is specifically responsible for conducting all soil, sediment, and surface water sampling associated with the Lenz Oil RI/FS. This includes coordination and implementation of sample collection, sample analyses, data validation, and data assessment. All data collected by the IEPA or its contractors will be submitted to ERM in monthly progress reports. Those portions of the RI technical memoranda and/or reports relating to the soil sediment and/or surface water investigation will also be prepared by IEPA or

its contractor and submitted to ERM for inclusion in the final memoranda and/or reports.

IEPA will perform the sample collection, data validation, data assessment, and report and technical memoranda preparation required for the Lenz Oil soil, sediment, and surface water investigations. Personnel of the IEPA Hydrogeology Unit will perform drilling operations and sample collection. ARDL, Inc., one of the IEPA contract laboratories, will analyze the soil, sediment, and surface water samples. The IEPA project manager will be responsible for coordination of these activities and timely submittal of the necessary data and reports to ERM.

2.1 Management

Operational responsibilities involving execution and direct management of the technical and administrative aspects of this project are shown on Figure 2-1 and are listed below:

General Project Management:

1. USEPA, Region V
   Nan Gowda
   Remedial Project Manager
   General project oversight

2. Lenz Oil Settling Respondents
   Mark C. Furse
   Common Counsel

Overall responsibility for completion of RI/FS
Respondent Contractor: ERM-North Central, Inc.

3. ERM-North Central, Inc.
John P. Imse
Project Manager
Overall management of RI/FS

4. Illinois EPA
David Dollins
Project Manager
Management of soil, sediment, and surface water investigation

Field Sampling:

1. ERM-North Central, Inc.
Site Coordinator
(to be determined)
Conduct soil gas and ground water investigations

2. Illinois EPA
Site Coordinator
(to be determined)
Conduct soil, sediment, and surface water investigations

Quality Assurance:

1. ERM-North Central, Inc.
   Douglas T. Anderson
   Quality Assurance Officer
   Overall quality assurance of soil gas and ground water investigation

2. Environmental Standards, Inc.
   R.J. Vitale
   Quality Assurance Officer
   Analytical quality assurance of soil gas and ground water investigations

3. Illinois EPA
   James G. Shaw
   Quality Assurance Officer
   Overall quality assurance for soil, sediment, and surface water investigations

2.2 Field Activity

ERM will perform or supervise all ERM field investigations. They will have a project manager who will be responsible for the overall execution of the Work Plan. Additionally, ERM will utilize a site coordinator who will be responsible for the execution of all ERM-North Central field activities in accordance with the approved QAPP and SAP. IEPA will similarly provide a project manager and site coordinator who will be responsible for the execution of all IEPA field activities in accordance with the approved QAPP and SAP.

List of ERM-North Central Subcontractors

Subcontractor	Service
Fox Drilling, Inc.	Soil boring and monitoring well installation
ARDL ,Inc.	Analytical services for ground water samples only
Pace Laboratories, Inc.	Analytical services for soil gas samples only
Environmental Standards, Inc.	Validation of ground water data
ATEC and Associates, Inc.	Geotechnical testing

List of IEPA Subcontractors

Subcontractor	Service
ARDL, Inc.	Analytical services for soil, sediment, and surface water

2.3 Laboratory Analysis

Pace Laboratories, in Minneapolis, Minnesota, will perform the soil gas analysis in accordance with their SOP (Appendix B). ARDL, Inc., of Mt. Vernon, Illinois, has been selected to conduct all TCLP, TCL and TAL analyses. ATEC and Associates, Inc. in Indianapolis, Indiana, will perform the particle size, total

porosity and total organic carbon analyses of the subsurface soil samples.

The laboratories' QA officer will be responsible for enforcing and documenting QA/QC procedures performed during the analytical work.

2.4 Quality Assurance Organization

Environmental Standards, Inc. (as a subcontractor to ERM) will review and validate all ground water data, including TICs, to ensure that they were developed in accordance with the approved QAPP and SAP. ERM will supply a QAO who will be responsible for reviewing the field data acquired by ERM to ensure that they were collected in accordance with the approved QAPP and SAP. IEPA will review and validate all soil, sediment, and surface water data to ensure that they were developed in accordance with the approved QAPP and SAP.

The Environmental Standards, Inc. (ESI) QAO officer may delegate the authority to conduct validation of the ground water laboratory data to another qualified ESI staff member. Qualified personnel from IEPA will perform validation of the soil, sediment, and surface water laboratory data under the direction of the IEPA QAO. Performance and system audits of the ERM field operations will be performed by the ERM QAO; whereas the IEPA QAO will conduct performance and system audits of the IEPA field operations. The USEPA Region V CRL will be responsible for external audits of field activities and the contract laboratories.

All subcontractors will provide appropriate project management, and ERM-North Central will furnish administrative oversight and QA/QC

for all Respondent deliverables. All IEPA subcontractors will provide appropriate project management, and IEPA will furnish administrative oversight and QA/QC for all deliverables. All Respondent deliverables will be issued by ERM-North Central. All deliverables required of the IEPA will be issued to ERM-North Central by IEPA. The specific QA management protocol is listed below.

TASK	RESPONSIBLE PARTY
Final review/approval of QAPP	USEPA Region V RPM and USEPA Region V QA Officer
QA review and approval of reports, Officer SOPs, and field activities; audits of reports, procedures, and activities for identifying, and controlling nonconformance corrective actions	ERM-North Central QA officer and/or IEPA QA Officer, as appropriate
Internal evidence audits of field records	ERM-North Central/IEPA QA Officer, as appropriate
Data assessment of soil gas and ground water data	ERM-North Central QA Officer, as appropriate
Data assessment of soil, sediment, and surface water data	IEPA QA Officer

TASK	RESPONSIBLE PARTY
Reassessment of soil, sediment, and surface water data and incorporation into Lenz Oil Technical Memos and Reports	ERM-North Central QA Officer
External Performance and System Audits of laboratories analysis	USEPA Region V CRL
External Performance and System Audits of field activities	USEPA Region V CRL and/or Central District Office (CDO)
Approval of QA Program and laboratory test procedures	USEPA Region V QA Section USEPA Region V CRL
Internal Laboratory Audits	ARDL, ATEC, and PACE QA Officers

2.5 Performance and System Audits

Performance and system audits for field operations performed by ERM or its field contractors will be conducted by the ERM QAO. IEPA's QAO will conduct performance and system audits of the field operations performed by IEPA or its field contractor. The performance and system audits of field operations will be conducted according to the field audit SOP (Appendix C), regardless of whether ERM or IEPA is conducting the audits. Field audits will

involve direct inspection of such activities as: monitoring well installation, sample collection, field measurements, and decontamination procedures to ensure that they are performed in accordance with the SAP and QAPP.

Internal performance and system audits of laboratory operations will be conducted by the QAOs from each laboratory. These audits will involve direct inspection of the laboratory procedures to ensure that they are performed in accordance with the QAPP.

The USEPA Region V CRL will be responsible for external audits of the laboratories; whereas both USEPA Region V CRL and USEPA Central District Office will be responsible for external field audits.

3.0 QUALITY ASSURANCE OBJECTIVES FOR PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY OF DATA

The overall Quality Assurance (QA) objectives are to develop and implement procedures for sampling, laboratory analysis, field measurement and reporting that will provide data to a degree of quality consistent with its intended use and defensible in a court of law. This section defines the goals for the quality control effort and the accuracy, precision, sensitivity, completeness, representativeness, and comparability of laboratory analyses.

The following definitions were extracted from USEPA, "Data Quality Objectives for Remedial Response Activities," March 1987, EPA/540/G-87-003.

- Accuracy measures the bias in a measurement system. Sampling accuracy may be assessed by evaluating the results of field/trip blanks; analytical accuracy may be assessed through use of known and unknown QC samples and matrix spikes.

- Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. The analytical results from collocated or field replicate samples provide data on overall measurement precision; analysis results from the laboratory replicates provide data on analytical precision.

- Completeness is defined as the percentage of measurements made which are judged to be valid measurements.

- Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is addressed by describing sampling techniques and the rationale used to select sampling locations.

- Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

3.1 Level of QC Effort

Quality Control (QC) samples will include collocated or replicate samples, and field and trip blanks. These QC samples will be submitted to the analytical laboratory to assess the quality of the data resulting from field sampling. Duplicate samples will be collected at a rate of one per 10 or fewer samples from the same locations as original samples using identical decontaminated sampling equipment.

Field blanks (rinsate) will be used to determine if decontamination procedures have been sufficient. They will be prepared by filling sample bottles with ultra-pure distilled, deionized water after it has been routed through decontaminated sampling equipment. These field blanks will be supplied at a rate of one per 10 or fewer samples.

Trip blanks, which will be kept with investigative samples throughout the sampling event, will be analyzed to check for procedural contamination of VOC samples that occurred during shipping. Trip blanks, containing organic-free, deionized water, will be provided by the laboratory at a rate of one set of two 40-ml glass vials per shipping cooler used for water and soil gas VOC samples. Trip blanks will not be used for soil and sediment samples.

The level of QC effort for field measurement of pH will consist of precalibration using two buffer solutions and calibration verification at regular intervals (at least once each day). QC effort for field conductivity measurements will consist of initial and continuing (at least once each day) calibration verification using a standard solution of known specific conductance. QC effort for HNu screening will consist of initial and continuing (at least every day) calibration verification using a standard reference gas.

In order to support the laboratory Quality Assurance Program, field samples will be collected and designated for matrix spike/matrix spike duplicate (MS/MSD) analysis at a rate of one per 20 or fewer samples. The laboratory will be a participant in the USEPA Contract Laboratory Program and will follow exactly the appropriate CLP SOWs.

3.2 Accuracy, Precision, and Sensitivity of Analyses

3.2.1 Field Instruments

The QA objectives of analyses with respect to accuracy, precision, and sensitivity are to achieve acceptable data, based on specified performance criteria. The project-required accuracy and precision of the field measurements are specified on Table 3-1 along with the estimated instrument accuracy and precision capabilities. The accuracy of field measurements of pH will be assessed through premeasurement calibrations and postmeasurement verifications using at least two standard buffer solutions. (The pH meter will be calibrated using two standard buffer solutions, and then the pH of both solutions will be measured.) The two measurements must each be within $\pm$ 0.05 pH units of the actual buffer solution values, or the meter will require recalibration. Precision will be assessed through duplicate measurements. (The electrode will be withdrawn, rinsed with deionized water, and reimmersed between each duplicate.) The duplicate measurement must be within $\pm$ 0.05 pH units of the initial measurement, or the meter will require recalibration. The instrument used will be capable of providing measurements to 0.01 pH units.

The accuracy of the specific conductance meter will be assured by daily calibration verification with solutions of known specific conductance. The accuracy of the specific conductance field measurements will be assessed by premeasurement calibration of the specific conductance meter and postmeasurement verification using solutions of known specific conductance. The measured specific conductance of the standard solution must be within 5 percent of the actual specific conductance of the solution, or the meter will

require recalibration. The sensitivity of the specific conductivity meter is 2.5 umhos/cm on the 0 to 500 umhos/cm range.

Sample temperature will be measured with the temperature probe on the conductivity meter. The sensitivity of this meter is 0.15°C. According to the manufacturer, the accuracy of the instrument is ± 0.6°C; however, the precision of the instrument is not stated. The precision and accuracy of the temperature probe will not be verified in the field because the project-specific precision and accuracy requirements for temperature are sufficiently large that verification is not required. Furthermore, it cannot be easily performed in the field.

3.2.2 Laboratory Instruments

The accuracy and precision requirements for TCL and TAL parameters are specified in the CLP 2/88 SOW for organics and the 7/88 SOW for inorganics. However, the accuracy and precision requirements in the most current SOWs in effect at the time sampling begins will be followed. A summary of the project-specific accuracy and precision requirements for all laboratory analyses is presented in Table 3-2. The precision and accuracy requirements for TCLP metals pertain only to the analysis of the TCLP extracts and not to the entire TCLP extraction/analysis combination.

3.3 Data Completeness, Representativeness, and Comparability

3.3.1 Field Analyses

Field analyses will provide data meeting the QC acceptance criteria for 90 percent or better of the samples tested.

3.3.2 Laboratory Analyses

It is expected that the TCL-organic and TAL-inorganic parameters analyses will provide data meeting the QC acceptance criteria for 95 percent or better of the samples analyzed. All other physical and chemical analyses will provide data meeting the QC acceptance criteria for 95 percent or better of the samples tested. Upon request, the completeness of an analysis will be documented by the laboratory with items such as chromatograms, spectra, and QC data to allow the data user to assess the quality of the results.

The sampling and analysis program is designed to provide data representative of site conditions. During development of this program, consideration was given to existing analytical data from previous studies at the site to ensure the representativeness of the data generated by this supplemental investigation. Data representativeness will be achieved by performing all field sampling and laboratory testing and analysis in a standardized manner that adheres strictly to the procedures specified in this QAPP.

Data comparability will be ensured by conducting all of the monitoring, screening, sampling, and analyses in a manner similar to the procedures used in previous studies at this site. Specifically, data comparability will be ensured by:

- Reporting results in appropriate units,
- Using the same or similar sampling procedures as in the other studies,

- Using the same or equivalent analytical procedures followed in other investigations, and

- Observing similar QA/QC requirements as in previous investigations on this site.

3.4 Documentation

The documentation system will comply with the requirements of CLP protocol. For the analysis provided by field measurements, the documentation will include the sample identification, the raw analytical results from the field instruments, and the quality assurance information from calibration of the field instruments. Included in the documentation of the field measurements will be an identification of the analyst as well as the collection time and date of each of the samples and Quality Control measures taken. PACE's SOP for Soil Gas Analysis in Appendix B contains information on the documentation of laboratory procedures, including precision and accuracy verification.

3.5 Quality Control Requirements

The sampling activities will include the following procedures for the purpose of quality control:

- Collection of field duplicates, including collocated and replicate samples;

- Collection of field blanks; and

- Inclusion of trip blanks in sample coolers that contain samples for analysis of VOCs.

The laboratories will follow the appropriate CLP SOWs QC requirements for the analytical measurements.

4.0 SAMPLING PROCEDURES

Sampling procedures are presented in the Sampling and Analysis Plan. It contains all appropriate information pertinent to field sampling equipment and procedures.

5.0 *SAMPLE CUSTODY PROCEDURES*

Sample custody procedures will be consistent with Attachment 4 of the USEPA Region V Guidance "Content Requirements for Quality Assurance Project Plans."

A sample will be considered under the person's custody if it is: (1) in a person's physical possession, (2) in view of the person after he or she has taken possession, (3) secured by that person so that no one can tamper with the sample, or (4) secured by that person in an area that is restricted to authorized personnel. The sample packaging and shipment procedures summarized below will assure that the samples will arrive at the laboratory with the chain-of-custody intact.

5.1 Field Custody Procedures

ERM and IEPA personnel will all follow the field sample custody procedures described below:

5.1.1 General Field Custody and Sample Identification

1. The field sampler(s) will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible will handle the samples.

2. After placing the sample into an appropriate container, the field sampler will affix properly completed sample tags and labels. All samples will be identified with labels and

tags that are securely attached to the sample containers. The labels and tags will present the following information:

- Sample number,
- Sample location,
- Name of collector,
- Affiliation of collector,
- Date and time of collection,
- Requested analysis, and
- Preservatives.

3. Sample tags and labels will be completed for each sample using waterproof ink. Sample labels will be completed first and adhered to the sample containers. Sample tags will be filled out second and attached to the sample containers.

5.1.2 Transfer-of-Custody and Shipment Procedures

1. Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the records. This record documents the transfer of custody of samples from the sampler to another person, to a permanent laboratory, or to/from a secure storage area. An example of the chain-of-

custody form to be used is presented in Figure 5-1.

2. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory.

3. A sample analysis request form will accompany each shipment of samples to the analytical laboratory. A description of the requested analysis will be included on this form. See Figure 3-2 in the Lenz Oil Data Management Plan.

4. A standardized sample tracking form will also be completed to establish sample custody prior to shipment to the laboratory and to document specific sample preservation methods. See Figure 3-3 in the Lenz Oil Data Management Plan.

5. An airbill from the overnight carrier will be used for shipment, and receipts from the airbill will be retained as part of the custody documentation. Commercial carriers are not required to sign off on the chain-of-custody forms as long as the custody forms are

sealed inside the sample coolers and the custody seals remain intact.

5.1.3 Field Notebooks and Documentation Procedures

- Field notebook entries will describe in as much detail as possible the data/sample collecting activities performed so that persons going to the site could reconstruct a particular situation without reliance on memory.

- Field notebooks will be bound field survey books or notebooks. Notebooks will be assigned to field personnel and stored in a document control center when not in use. Each notebook will be identified by the project-specific document number.

- The title page of each notebook will contain the following:

  - Person to whom the notebook is assigned,
  - Notebook number,
  - Project name,
  - Project start date, and
  - Project end date.

- At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal

protection being used, and the signature of the person making the entry will be recorded.

- The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will be entered in the field notebook.

- Measurements made and samples collected will be recorded.

- All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark.

- Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, which includes compass and distance measurements, shall be recorded. The number of the photographs taken of the station, if any, will also be noted.

- All equipment used to make measurements will be identified, along with the date of calibration.

- Samples will be collected following the sampling procedures documented in the Sampling and Analysis Plan. The equipment used to collect samples will be noted, along with the time of sampling, sample number and

description, depth at which the sample was collected, volume and number of containers. Sample identification numbers will be assigned prior to sample collection.

5.2 Laboratory Custody Procedures

The chain-of-custody procedures to be followed by ARDL, PACE, and ATEC can be found in Appendices D, B, and E, respectively.

5.3 Final Evidence File

ERM, the RI/FS contractor, will maintain the final evidence file for the Lenz Oil Service RI/FS. ERM's project manager for the Lenz Oil RI/FS will be the evidence file custodian. The contents of the evidence file will be kept in a dedicated, locked file that will have controlled access.

The evidence file will contain originals or copies of all project-related documents, including:

- A set of approved RI/FS Work Plan documents;
- Copies of all progress reports, addendum Work Plan documents, and Technical Memoranda;
- Completed field log books, sample log sheets, pictures, and boring logs;
- Copies of all laboratory information, including case narratives, raw data, instrument printouts, QC data, etc.;

- Copies of all analytical results;
- Copies of subcontractor reports, including data validation reports;
- Copies of completed sample custody documentation (i.e., chain-of-custody forms and airbills);
- All project-related communications; and
- Any other project-related documentation.

All of the evidence file contents generated by IEPA or its subcontractors will be sent to ERM along with the monthly progress report. ERM will incorporate the IEPA-generated documents into the final evidence file monthly. ERM will maintain the final evidence file for at least two years after completion of the RI/FS. The evidence file will be offered to the USEPA prior to final disposal of the file contents.

6.0 CALIBRATION PROCEDURES

This section presents the calibration procedures and information for all major measurement systems including field and analytical laboratory testing.

6.1 Field Instruments

A maintenance and calibration program will be implemented to ensure that routine calibration and maintenance are performed on all field instruments. The program will be administered by the field team leader who will perform routine preventative maintenance (e.g., cleaning or other procedures identified in the SOP and instrument manual) on a weekly basis and calibration of field instruments on a daily basis. Calibration activities will include the use of buffer solutions for calibrating the pH meter, liquids of known conductance for calibrating the specific conductance meter, and a standardized reference gas for calibration of the HNu photoionization meter.

All field personnel will be familiar with the calibration, operation, and maintenance of all field instruments and will maintain their proficiency. Operating procedures outlined in the manual for each instrument will be followed. If field equipment should fail, the field team leader will be contacted immediately and will either provide replacement equipment or have the malfunction repaired immediately. Calibration and maintenance procedures are included in Appendices F-H. The frequencies of calibration are as follows:

- Conductivity (YSI) meter - daily,
- HNu meter - daily,

- pH Meter - daily, and
- Temperature meter - at least daily.

The pH meter will be calibrated using the two-buffer approach. The calibration will be checked after the analysis of every five samples or following the analysis of any sample that has an extremely high or extremely low pH. The pH calibration check shall be made at the beginning of every day and periodically during the field evaluation. Following the calibration, deionized water will be used to clean the probe, and it will be analyzed to determine whether there has been any carryover from the previous sample(s).

The photoanalyzer (HNu) will be calibrated at the beginning of each day, and its calibration shall be checked once each day using the procedure in Appendix F. The HNu will be calibrated using isobutylene. The initial multipoint calibration of the HNu will be performed by the equipment supplier.

The conductivity and temperature meter shall be calibrated in the field on a daily basis. The calibration shall be checked periodically. The procedure will be as described in Appendix H.

Each well will be marked with a reference point, indicated on the well casing, from which the water level and well depth measurement will be taken. The reference point elevation of each well will be established with respect to U.S. Datum Mean Sea Level elevation to an accuracy of 0.01 feet. The height of the reference point above ground surface will also be determined during the survey.

Static water level measurements will be taken using a Solinist water level indicator equipped with a graduated measuring tape and

a stainless-steel probe. The stainless-steel probe will be slowly lowered down the monitoring well until the indicator produces an audio signal that indicates contact with the water surface. The depth to water will then be read from the Teflon tape. The probe will be withdrawn just above the water surface, and a second reading will be made prior to measuring the well depth. Before lowering the probe into the monitoring well, the batteries will be checked by pressing the test button on the instrument. The well depth will then be measured by lowering the stainless-steel probe to the base of the well and reading the depth on the tape. This measurement must be corrected by adding the length of the probe to the measurement. The water level indicator will be decontaminated with a TSP wash and triple rinsed between each well.

6.2 Laboratory Equipment

ARDL, PACE, and ATEC will be responsible for the calibration and maintenance of the analytical equipment used for laboratory analyses. ARDL will follow exactly the procedures outlined in the CLP SOW - 2/88 for TCL organics and CLP SOW - 7/88 for TAL inorganics, or the most current versions at the date sampling begins. The SOP used by ARDL for TCLP extraction and metals analysis is included in Appendix D. ARDL will analyze the TCLP extract using the exact procedures, including calibration, outlined in the CLP SOW-7/88 for inorganics, or the most current version. Discussions of the calibration frequency and methodology for non-CLP analyses (e.g., soil gas, particle size, total porosity, and TOC analyses) are presented in the SOPs for each of these analyses. See Appendix B for PACE's SOP for the determination of volatile organic compounds in soil gas and Appendix E for ATEC's SOPs for particle size, total porosity, and TOC analyses.

7.0 ANALYTICAL PROCEDURES

Samples collected for TCL organics and TAL inorganics analysis will be analyzed in a manner in complete compliance with CLP procedures. The complete list of CLP TCL and TAL parameters and the corresponding Contract Required Quantitation Limits are presented in Table 1-1. The CLP TCL and TAL analyses will be conducted by ARDL, Inc. using methods specified in the 2/88 RAS SOW for organics and the 7/88 RAS SOW for inorganics, or the most current versions that are used by CLP laboratories at the time sampling begins. If sample dilution is required to the degree that certain constituents are diluted to below their respective method detection limits, the laboratory will be consulted to explore methods of detecting all constituents. As stated in ARDL's SOP for TCLP extraction and analysis (see Appendix D), the TCLP extracts will be analyzed for metals using the exact methods specified in the RAS SOW-7/88 for inorganics, or the most current version at the time sampling begins. The SOPs the determination of volatile organic compounds in soil gas, prepared by PACE Laboratories, is presented in Appendix B. The SOPs for particle size analysis, total porosity determination, and TOC concentration, prepared by ATEC Associates, Inc., are included in Appendix E. If a Phase II of the RI/FS is necessary to conduct residential well sample analysis, non-RAS SOPs that achieve the lower, residential well detection limits will be included in the addendum QAPP that will accompany the addendum Work Plan and SAP.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

The responsibilities and procedures for: (1) documenting sample collection and custody, (2) reducing field and analytical data, (3) validating analytical data, and (4) reporting the results of each phase of the RI are covered in this section.

Data reduction will be performed by the laboratory or contractor that generates the data. ERM and IEPA will be responsible for reducing their own field data. ARDL, PACE, and ATEC will likewise be responsible for reducing their own analytical data. Validation of the ground water data will be performed by Environmental Standards, Inc., and the soil, sediment, and surface water data will be validated by IEPA. The other field and analytical data do not require validation.

Each laboratory and contractor is responsible for reporting the data generated to either ERM or IEPA, depending upon the contractual arrangement. IEPA is responsible for reporting all data generated by it or its contractors to ERM. As the participating respondents' contractor, ERM is responsible for reporting all data generated for the Lenz Oil RI/FS to USEPA.

The data reduction, validation, and reporting by the laboratory are summarized as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.

- The area supervisor reviews the data for attainment of quality control criteria as

outlined in the SOPs and established EPA methods and for overall reasonableness.

- Upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the laboratory Quality Assurance Officer.

- The laboratory Quality Assurance Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency.

- The laboratory QA Officer and area supervisor will decide whether any sample re-analysis is required.

- Upon acceptance of the preliminary reports by the laboratory QA Officer, final reports are generated and signed by the laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

8.1 Documentation

Information pertaining to sample collection, sample custody, analyses to be performed, field measurements, and other field observations will be documented in accordance with procedures contained in the Data Management Plan. Field measurements and sample collection data will be recorded on specific field data forms and in a field notebook. Sample custody and requests for

analytical tests to be performed will be documented on sample tracking forms, chain-of-custody records, and sample analysis request forms.

Laboratory documentation procedures utilized by ARDL, PACE, and ATEC are provided in Appendices D, B, and E, respectively.

8.2 Data Reduction

The only data reduction needed for field data will be for that data generated by the HNu and conductivity meters when a scaling factor is used. For example, on the YSI Conductivity Meter, if the reading was 247 and the scale was x 10, then the actual value would be 2,470 micromhos/cm. This same procedure applies to the HNu meter.

The field notebook used to document the calibrations will contain information on the scale and readings corresponding to the standards. Field measurements will be adjusted for the scale used and the data will be reported in appropriate units (pH in units of pH, conductivity in mhos, and HNu readings in Vppm).

Analytical data reduction will be carried out in-house by ARDL and PACE Laboratories on their respective data sets. Reduction of all TCL-organic and TAL-inorganic data will be completed by ARDL in exact accordance with the CLP 2/88 SOW for organics and 7/88 SOW for inorganics, or the most recent versions. Because the TCLP extract will be analyzed for metals in strict accordance with the CLP 7/88 SOW for inorganics, the TCLP metals data will be reduced by ARDL using the applicable procedures outlined in the CLP 7/88 SOW for inorganics (see Section 10.0 of the SOP in Appendix D). Reduction of the TCL-organic, TAL-inorganic, and TCLP-metals data

ensure that the actual quantities reported are accurate and appropriately qualified. The reported quantities will be as detected, qualified or not, by the laboratory. Compounds detected in blanks will not be subtracted from the analytical results of investigative samples and will be reported separately.

Reduction procedures to be implemented by PACE for the soil gas data are presented in Section M of the soil gas analysis SOP in Appendix B. Data reduction procedures used by ATEC for the particle size and total porosity analyses are described in Section 16 of the respective SOPs (Appendix E). Section B of the TOC SOP, prepared by ATEC, presents data reduction procedures for that analysis.

8.3 Data Validation

ARDL and Pace Laboratories will perform in-house analytical data validation under the direction of their respective laboratory QA Officers. Their validation will be limited to identifying and flagging the laboratory QC outliers described in the CLP RAS organic and inorganic SOWs, if applicable, and any other laboratory QC outlier flags described in their SOPs for non-CLP methods (Appendices D and B). Additionally, the laboratories will critique their own analytical programs by using spiked addition recoveries, established detection limits, and precision and accuracy control charges and by keeping accurate records of the calibration of instruments.

Environmental Standards, Inc. (on behalf of ERM) will independently validate the ground water analytical data, whereas IEPA will validate the soil, sediment and surface water data. The USEPA documents "Laboratory Data

IEPA. All data, qualified or unqualified, will be presented in Technical Memoranda as tables or supporting appendices for the memoranda. Interpretive or summary data sets will be provided in addition to the completely reported data. All laboratory reports and verification calculations for QA/QC will be prepared in exact accordance with the SOW 7/88 for metals and SOW 2/88 for organics for CLP analyses, or both the laboratory SOPs and QAPP for non-CLP analyses. The data deliverables packages, including some examples of reporting forms, are described in the SOPs for the non-CLP analyses (Appendices B, D, and E). Any of the following deliverables that are not described in the analytical SOPs will be provided as documentation for the non-CLP parameters, if applicable:

- Field and laboratory sample numbers;
- Date of sample collection;
- Dates of sample receipt, extraction, and analysis;
- Case description, including sample preparation and analysis, problems encountered, and corrective action taken during the process of sample preparation and analysis;
- Summary of initial calibration and continuing calibration check results;
- Raw data;

- Chromatograms and other instrument printouts when applicable;
- Summary of analytical results reported in appropriate units;
- Summary of QC analyses (including blanks, MS/MSD, etc.); and
- Copies of laboratory notebooks.

All site investigation data will be analyzed, and a summary interpretation will be developed for the type and extent of contamination from the site. The final data package will include a summary of analytical results, and all field and laboratory data. The summaries will be submitted as technical memoranda at the completion of the RI.

The analytical reports will include a summary of the analysis by matrix sampling location, date of sample, and date of analysis. The report will have an appendix that contains all the laboratory reports, chain-of-custody forms, and field notes applicable to the samples.

The final field data will be presented in summary tables. Raw data and instrument readings that were recorded on site will be represented in tables. The final field data will include the following:

- A summary table of field data,
- Daily activity summary,

- Photographs,
- Any instrument printouts, and
- Field audit results.

9.0 INTERNAL QUALITY CONTROL CHECKS

9.1 Field Quality Control

Field quality control will be carried out during all field activities, such as ground water sampling, by an experienced geologist or engineer. The on-site supervisor will be present during all sampling activities and subcontracted activities such as drilling. All field quality control procedures will be carried out according to the QAPP and documented in the field notebook. These will include the daily instrument calibration checks and the collection of duplicate and field blanks.

The on-site supervisor will maintain the field quality control notebook. In the notebook, on a daily basis, the following quality control procedures will be reviewed and documented by the supervisor:

- Sample collection in accordance with the sampling procedures,
- Proper decontamination of sampling equipment,
- Collection of field blank samples,
- Collection of field duplicate samples, and
- Calibration of field instruments.

The sample collection procedure will be observed by the on-site supervisor. The sampling procedures will be reviewed against the detailed procedures outlined in the Sampling and Analysis Plan, and documented in this QAPP. Any corrective action taken, such as

instructions to a sampling team member on how to alter the sample collection or decontamination procedures, shall be noted by the supervisor.

Decontamination procedures will be observed and corrective actions to any programs that are necessary shall be documented by the field supervisor. Collection of field blanks shall be noted in the field notebook. Additionally, field duplicates as well as trip blanks will be noted by the supervisor in the field notebook.

The calibration of field instruments will be observed by the supervisor. The calibration procedure and sequence for each of the instruments will be verified by the supervisor and documented in the field notebook.

The well installation quality assurance program will be monitored by the contractor's on-site supervising geologist. Well installation logs will be kept by both the driller and the contractor's geologist. Continuous split-spoon samples will be collected during well installation to determine the appropriate locations of well screens. ERM's geologist will maintain a field notebook and record each step of the well installation and development program. Decontamination procedures will be observed and recorded. A photographic log will supplement the records in the field notebook.

9.2 Laboratory Quality Control

ARDL will perform the internal quality control checks, laboratory performance, and systems audits specified in the CLP RAS SOWs for organic (2/88) and inorganic (7/88) analyses. These QC checks will apply to all TCL organic and TAL inorganic analyses, including the metals analysis of the TCLP extract.

The internal QC checks for CLP analyses are summarized below:

Parameter	QC Check Method
TAL Inorganics	Preparation Blanks
	Sample Spikes
	Sample Duplicates
	Laboratory Control Samples
	Detection Limits Report
TCL Organics	Procedural and Solvent Blanks
	Surrogate Spikes
	Matrix Spike Duplicates
	Compound Identification Criteria

For non-CLP analyses, the internal QC checks are summarized below and discussed in further detail in their respective SOPs (Appendices D, B and E).

Parameter	QC Check Method
Soil Gas Volatile Organics	Matrix Spikes
	Matrix Spike Duplicates
	Sample Duplicates
	Surrogate Spike
	Laboratory Reagent Blanks
	Detection Limits Report
	Laboratory Method Blanks
	Laboratory QC Samples
Particle Size	Duplicate Samples
Total Porosity	Duplicate Samples

Parameter	QC Check Method
TOC	Laboratory Method Blanks
	Duplicate Samples
	Calibration Check Samples
	Matrix Spike
	Matrix Spike Duplicate
	Quadruplicate

10.0 PERFORMANCE AND SYSTEM AUDITS

ERM's project manager will monitor and audit the performance of QA/QC procedures to ensure that the RI data collection work is executed in accordance with this QAPP.

10.1 Internal Audits

10.1.1 Field Activities

QA audits of field measurement procedures, sample collection, and sample custody procedures will be conducted on a periodic basis by ERM's QAO and IEPA's QAO to document that field activities are performed in accordance with the Sampling and Analysis Plan. ERM's QAO is responsible for conducting audits of the field activities performed by ERM and its subcontractors; whereas the field activities conducted by IEPA and its contractors will be audited by the IEPA QAO. These audits will be scheduled to allow oversight of as many field activities as possible. At least monthly during the field investigation work, the QAOs will conduct independent QA audits of the field work. Both ERM and IEPA will conduct the field audits in accordance with the Field Audit SOP (Appendix C).

10.1.2 Laboratory Activities

The laboratory QA audits will be the responsibility of the laboratories' QAOs. The procedures to be followed by ARDL, PACE and ATEC are summarized in Table 10-1 and documented in more detail in Appendices D, B and E, respectively. ERM's QAO will be responsible for verifying that the laboratories have conducted the appropriate audits. This will be done through a review of the audit reports produced by the laboratory QAOs.

10.2 External Audits

The USEPA Region V Central Regional Laboratory (CRL) will be responsible for external audits of the contracted laboratories. The USEPA Region V CRL and the USEPA Central District Office (CDO) have co-responsibility for external field audits.

USEPA external field audits may include a review of analytical and chain-of-custody procedures. Site audits in the field will be performed by USEPA personnel who adhere to the requirements in the approved Health and Safety Plan.

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Equipment

Preventative maintenance procedures for the HNu photoionization meter, conductivity meter, and pH meter will be carried out in accordance with operating manuals for the respective instruments. The SOPs for these instruments are included in Appendices F-H.

Preventative maintenance of the soil gas survey equipment will include the following procedures:

- The soil gas sampling train will be decontaminated and inspected for damage between each sampling location;
- The sampling train will be fitted with new flexible Teflon tubing at the beginning of the sampling event;
- The personal sampling pump will be checked for proper operation and pumping rate at the beginning of the sampling event and daily thereafter;
- The sampling train and sample cartridges will be stored and transported in appropriate containers to avoid damaging the equipment; and

- Prior to collecting each sample, the entire sampling train will be visually inspected for proper operation.

11.2 Laboratory Equipment

The preventative maintenance procedures for the laboratory equipment will be the responsibility of ARDL, Pace, and ATEC Laboratories. ARDL's, PACE's and ATEC's preventative maintenance programs are documented in Appendices D, B and E, respectively.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Data assessment will be conducted by ERM's QAO and IEPA's QAO, or their designee(s). The ERM QAO is responsible for assessing the precision, accuracy and completeness of the: (1) ground water analytical data, (2) soil gas analytical data, (3) ERM-generated field data, and (4) geotechnical soil data. The IEPA QAO is responsible for assessment of the: (1) soil, sediment, and surface water analytical data; and (2) the field data collected by IEPA or its subcontractors. The purpose of data assessment is to evaluate whether or not the project-required QA objectives for precision, accuracy, and completeness have been met by the set of field and laboratory data that was generated.

The following equations will be used for data assessment:

- Spike Sample Analysis (Accuracy Calculation)

$$\text{Percent Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

Where:

SSR = Spiked Sample Results
SR = Sample Result
SA = Spike Added

- Duplicate Sample Analysis (Precision Calculation)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

RPD = Relative Percent Difference
S = First Sample Value (original)
D = Duplicate Sample Value

- Standard Deviation

$$SD = SQRT \frac{(X_i - X_m)^2}{n - 1}$$

Where:

X_i = Sample Value
X_m = Sample Value Average
n = Number of Samples (values)
SQRT = Square Root

- Relative Standard Deviation

$$\%RSD = \frac{SD}{\overline{x}} \times 100$$

Where:

RSD = Relative Standard Deviation
SD = Standard Deviation of Initial Relative Response Factors (per compound)
$\overline{x}$ = Mean of Initial Relative Response Factors (per compound)

- Percent Difference

$$\%D = \frac{I - S}{I} \times 100$$

Where:

I = Initial Sample Result
S = Other Result (e.g., Serial Dilution)

- Data Completeness

$$\%C = \frac{VM}{M} \times 100$$

Where:

% C = Percent Completeness
VM = Amount of valid data
M = Total data expected under normal conditions

13.0 CORRECTIVE ACTION

13.1 Immediate Corrective Action in the Field

If a problem occurs in the field that may be immediately correctable by direct action, then ERM's field Quality Assurance Officer will see that the action is taken. For example, if poor sampling techniques are observed in the collection of a sample, the sample will be re-collected under the supervision of ERM's field QAO, and steps will be taken to prevent a reoccurrence of the problem. All problems and corrective actions will be documented in a Corrective Action Form (Figure 13-1).

13.2 Immediate Corrective Action in the Laboratory

Any problems that occur during analysis that are immediately correctable (i.e., would not require additional field work to correct) will be the responsibility of the laboratory to solve. ARDL's, PACE's, and ATEC's corrective action procedures are found in Appendices D, B, and E, respectively. At no time will the laboratory deviate from the CLP SOW protocol (SOW-2/88 for organics and SOW-7/88 for inorganics).

13.3 Other Corrective Action

Problems such as determining that insufficient sample volume is available or finding the monitoring wells are dry are not immediately correctable in the field. If such a problem is encountered, the field QAO will contact ERM's project manager. This project manager will then contact the Lenz Oil Site Settling Respondents, USEPA, and IEPA. These parties will reach an agreement

as to the corrective action warranted. The field QAO will be responsible for implementing the agreed action. This same procedure will be followed if audit results or detection of unacceptable data indicate that resampling is necessary.

If there is a problem with laboratory performance that is not immediately correctable, the proposed corrective action will be discussed in a proposal by the laboratory's QAO. This report will be presented by ERM's project manager to the representatives of the Lenz Oil Settling Respondents and the Agencies. The corrective action will be implemented only after full agreement on the required action has been reached by the regulatory Agencies and the Lenz Oil Site Settling Respondents. The Laboratory project manager will be responsible for implementing any corrective actions under his/her control.

14.0 QUALITY ASSURANCE REPORT

ARDL's and Pace Laboratories' QAOs shall provide monthly quality assurance reports to ERM's project manager. These reports, along with the results of any field or laboratory audits conducted during the quarter, shall form the basis of the quarterly quality assurance report that will be provided by ERM and IEPA to the USEPA. The report will contain information that summarizes the quality assurance activities in both the field and the laboratories. The report will discuss any quality issues that required corrective action and will document the corrective action that has been taken. The report will note any project problems that have resulted and any quality assurance/quality control issues that have been satisfactorily completed. However, any problems serious enough to require significant actions (e.g., changing an approved SOP) will be reported to the USEPA within 5 days of the occurrence.

TABLES

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
I. Volatiles	CAS Number	(ug/l)	(ug/kg)
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-34-3	5	5
10. 1,2-Dichloroethene (total)	540-59-0	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,2-Dichloropropane	78-87-5	5	5
19. cis-1,3-Dichloropropene	10061-01-5	5	5

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis as required by the contract, will be higher.

(3) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for volatile TCL compounds are 125 times the individual Low Soil/Sediment CRQL.

Note:

This table has been modified to conform to the "Final Standard Quality Assurance Project Plan Content Document," prepared for the USEPA, Region V by Camp Dresser & McKee, Inc., dated June 14, 1989.

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
I. Volatiles	CAS Number	(ug/l)	(ug/kg)
20. Trichloroethene	79-01-6	5	5
21. Dibromochloromethane	124-48-1	5	5
22. 1,1,2-Trichloroethane	79-00-5	5	5
23. Benzene	71-43-2	5	5
24. trans-1,3-Dichloropropene	10061-02-6	5	5
25. Bromoform	75-25-2	5	5
26. 4-Methyl-2-pentanone	108-10-1	10	10
27. 2-Hexanone	591-78-6	10	10
28. Tetrachloroethene	127-18-4	5	5
29. Toluene	108-88-3	5	5
30. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
31. Chlorobenzene	108-90-7	5	5
32. Ethyl Benzene	100-41-4	5	5
33. Styrene	100-42-5	5	5
34. Xylenes (Total)	1330-20-7	5	5

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis as required by the contract, will be higher.

(3) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for volatile TCL compounds are 125 times the individual Low Soil/Sediment CRQL.

Note:

This table has been modified to conform to the "Final Standard Quality Assurance Project Plan Content Document," prepared for the USEPA, Region V by Camp Dresser & McKee, Inc., dated June 14, 1989.

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
II. Semi-Volatiles	CAS Number	ug/l	ug/kg
35. Phenol	108-95-2	10	330
36. bis(2-Chloroethyl)ether	111-44-4	10	330
37. 2-Chlorophenol	95-57-8	10	330
38. 1,3-Dichlorobenzene	541-73-1	10	330
39. 1,4-Dichlorobenzene	106-46-7	10	330
40. Benzyl alcohol	100-51-6	10	330
41. 1,2-Dichlorobenzene	95-50-1	10	330
42. 2-Methylphenol	95-48-7	10	330
43. bis(2-Chloroisopropyl)ether	108-60-1	10	330
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-di-n-dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic acid	65-85-0	50	1600
52. bis(2-Chloroethoxy)methane	111-91-1	10	330
53. 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

(3) Medium soil/sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 60 times the individual low soil/sediment CRQL.

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
II. Semi-Volatiles	CAS Number	ug/l	ug/kg
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
59. 2-Methylnaphthalene	91-57-6	10	330
60. Hexachlorocyclopentadiene	77-47-4	10	330
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-Trichlorophenol	95-95-4	50	1600
63. 2-Chloronaphthalene	91-58-7	10	330
64. 2-Nitroaniline	88-74-4	50	1600
65. Dimethylphthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 2,6-Dinitrotoluene	606-20-2	10	330
68. 3-Nitroaniline	99-09-2	50	1600
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1600
71. 4-Nitrophenol	100-02-7	50	1600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. Diethylphthalate	84-66-2	10	330

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

(3) Medium soil/sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 60 times the individual low soil/sediment CRQL.

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
II. Semi-Volatiles	CAS Number	ug/l	ug/kg
75. 4-Chlorophenyl-phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl-phenylether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butylbenzylphthalate	85-68-7	10	330
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. Chrysene	218-01-9	10	330
92. bis(2-Ethylhexyl)phthalate	117-81-7	10	330
93. Di-n-octylphthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

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TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
II. Semi-Volatiles	CAS Number	ug/l	ug/kg
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

(3) Medium soil/sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 60 times the individual low soil/sediment CRQL.

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
III. Pesticides/PCBs	CAS Number	ug/l	ug/kg
100. alpha-BHC	319-84-6	0.05	8.0
101. beta-BHC	319-85-7	0.05	8.0
102. delta-BHC	319-86-8	0.05	8.0
103. gamma-BHC (Lindane)	58-89-9	0.05	8.0
104. Heptachlor	76-44-8	0.05	8.0
105. Aldrin	309-00-2	0.05	8.0
106. Heptachlor epoxide	1024-57-3	0.05	8.0
107. Endosulfan I	959-98-8	0.05	8.0
108. Dieldrin	60-57-1	0.10	16.0
109. 4,4'-DDE	72-55-9	0.10	16.0
110. Endrin	72-20-8	0.10	16.0
111. Endosulfan II	33213-65-9	0.10	16.0
112. 4,4'-DDD	72-54-8	0.10	16.0
113. Endosulfan sulfate	1031-07-8	0.10	16.0
114. 4,4'-DDT	50-29-3	0.10	16.0
115. Methoxychlor	72-43-5	0.5	80.0
116. Endrin ketone	53494-70-5	0.10	16.0
117. alpha-Chlordane	5103-71-9	0.5	80.0
118. gamma-Chlordane	5103-74-2	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

(3) Medium soil/sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 15 times the individual low soil/sediment CRQL>

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

		Quantitation Limits[2]	
		Water	Low Soil/Sediment[3]
III. Pesticides/PCBs	CAS Number	ug/l	ug/kg
120. Aroclor-1016	12674-11-2	0.5	80.0
121. Aroclor-1221	11104-28-2	0.5	80.0
122. Aroclor-1232	11141-16-5	0.5	80.0
123. Aroclor-1242	53469-21-9	0.5	80.0
124. Aroclor-1248	12672-29-6	0.5	80.0
125. Aroclor-1254	11097-69-1	1.0	160.0
126. Aroclor-1260	11096-82-5	1.0	160.0

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

(3) Medium soil/sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 15 times the individual low soil/sediment CRQL>

TABLE 1-1

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)[1]
FOR THE CONTRACT LABORATORY PROGRAM (CLP)

	Quantitation Limit [1,2]
IV. T.A.L. Metals	ug/l
1. Aluminum	200
2. Antimony	60
3. Arsenic	10
4. Barium	200
5. Beryllium	5
6. Cadmium	5
7. Calcium	5000
8. Chromium	10
9. Cobalt	50
10. Copper	25
11. Iron	100
12. Lead	5
13. Magnesium	5000
14. Manganese	15
15. Mercury	0.2
16. Nickel	40
17. Potassium	5000
18. Selenium	5
19. Silver	10
20. Sodium	5000
21. Thallium	10
22. Vanadium	50
23. Zinc	20
24. Cyanide	10

(1) Elements determined by inductively coupled plasma emission or Atomic Absorption (AA) Spectroscopy.

(2) Quantitation limits for water.

TABLE 1-2

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) TARGET PARAMETERS AND QUANTITATION LIMITS

Parameter	Regulatory Level (mg/l)	PRDL (mg/l)	Est. MDL (mg/l)	
			Soil	Water
Arsenic	5.0	<5.0	0.001	0.005
Barium	100.0	<100.0	0.028	0.014
Cadmium	1.0	<1.0	0.009	0.0045
Chromium	5.0	<5.0	0.0026	0.0013
Lead	5.0	<0.2	0.0028	0.0014
Mercury	0.2	<1.0	0.0004	0.0002
Selenium	1.0	<1.0	0.001	0.0005
Silver	5.0	<5.0	0.018	0.0092

Notes:

PRDL: Project-Required Detection Limit

Est. MDL: Estimated Method Detection Limit

TABLE 1-3

SOIL GAS TARGET PARAMETERS AND QUANTITATION LIMITS

PARAMETER	PRDL (ppmV)	EST MDL (ppmV)
Cis 1,2-dichloroethene	0.40	0.05
Trans 1,2-dichloroethene	0.33	0.05
1,2-dichloroethane	0.05	0.05
1,1,1-trichloroethane	0.18	0.04
Trichloroethene	0.34	0.04
Toluene	0.34	0.05
Xylenes	0.32	0.05

PRDL: Project-Required Detection Limit

ppmV: part per million by volume

EST MDL: Estimated Method Detection Limit

TABLE 2-1

LENZ OIL SETTLING RESPONDENTS

A&W Auto Tires & Service

A.A. Anderson, Inc.

* Aamco Transmission, Aurora

* Aamco Transmission, Chicago

Aamco Transmission, Des Plaines

* Aamco Transmission, Lisle

All Brake and Drive Unit Service, Inc.

Alpha School Bus Company, Inc.

* American Environmental Construction
(f/k/a E&E Hauling, Inc.)

American National Can

American Steel Foundries

Amoco Corporation
(including Standard Oil Division and Amoco Chemical Company)

* Archie L. Bentz, Jr., Inc.
(d/b/a Bentz's Mobil, Inc.)

* Arrow Plastic Mfg. Co.

Ashland Chemical Company

Aurora Municipal Airport

Autotrol Corporation

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* The asterisk indicates a Respondent that was not a party to the initial Judicial Consent Decree with the Illinois Environmental Protection Agency.

TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

* Avon Gear & Engineering Co.

Azzarelli Construction Co.

Babe's Standard Service
(a Division of Rae Enterprises, Inc.)

* Badger Marine Hardware Company

Belson Scrap & Steel, Inc.

Benoy Motor Sales

Bernie's Service
(f/k/a Bernie's Shell Service)

* Bob Cheesman Chevrolet-Oldsmobile

Bodine Electric Company

Boncosky & Co., Inc.
(for Bunge's Arco)

Boncosky Transportation, Inc.

Borg Pontiac-GMC, Inc.

Borg-Warner Corporation

Bower Motors, Inc.

Boys Motor Car Service

Bruce Grey & Co.
(a/k/a Bakerlift of Chicago, Inc.)

Budget Rent a Car Corporation

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* The asterisk indicates a Respondent that was not a party to the initial Judicial Consent Decree with the Illinois Environmental Protection Agency.

TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Buffalo Grove, Village of

Bulkamatic Transport Company

Burren Transfer Co.

Busch Auto Service Center, Inc.

Butler Aviation-Midway, Inc.

Butler Walker, Inc.

Cardox, Div. of Liquid Air Corp.

Century Wholesale Company

Chicago Eastern Corporation

Chicago Kenworth, Inc.

Chicago Tribune Company

* Chiricotti Enterprises
(including North Avenue Standard Service,
Elm Park Amoco, & Louis Amoco)

Chuck's Garage, Inc.

Coca Cola Bottling Company of Chicago

Coffman Truck Sales, Inc.
(d/b/a Coffman White GMC Truck Sales)

Commonwealth Edison

Conlon-Collins Ford, Jeep Eagle, Inc.

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Container Corporation of America
(an affiliate of Jefferson Smurfit Corporation)

Continental Honda

Continental Toyota, Inc.

Crystal Lake Disposal Service, Inc.

* Custom Enterprises, Inc.
(a/k/a Custom Amoco)

Dante Gentilini Trucking, Inc.

* Delco GM
(a Division of General Motors)

Dick James Ford

Diller-Rod Inc.

Don McCue Chevrolet, Inc.

* Don Schmal's Service
(a/k/a Schamal's Don Service)

* Downers Grove, Village of

DuPage, County of

* Duane Olson's Service Center

* ESL Landfill
(a Division of Waste Management of Illinois, Inc.)

* E.I. Du Pont De Nemours and Co.

E.M. Melahn Construction Company

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Ed James Chevrolet, Inc.

Ed's Automotive

Egan, Inc.
(f/k/a Egan Buick/Datsun, Inc.)

Elgin Equipment Co.

* Elgin, Joliet & Eastern Railway Co.

Exolon ESE Company

Federal Paper Board Company, Inc.

Field Container Corp.

Firestone Tire & Rubber Company

Flexible Steel Lacing

Fox Valley Disposal
(a Division of Waste Management of Illinois, Inc.)

Fraher Ford

Frank D'Aversa Auto Service, Inc.

Freund Equipment, Inc.

* Fuller's Service Center, Inc.

Gardner Sales & Service, Inc.

Goding Electric Co.

* Goodyear Tire & Rubber Co.

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

* Grand Service Center, Inc.

* Grayslake Shell

Great Lakes Terminal & Transport

Griffin Dewatering Corp.

Griffin Wellpoint Corp.

Group Construction Co.

Halliburton Services
(a Division of Halliburton Co.)

Hammond, City of

Hansen Plastics Corp.

* Harvard Implement, Inc.

Henry Valve Company, Inc.

Hertz Corporation (The)

Hoechst Celanese Corporation

Hogan Implement Co., Inc.

* Howard's Auto Care

Hunt's Service Station

Illinois Auto Electric Co.
(settled with EPA as Illinois Auto Central)

* Illinois Dept. of Transportation

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Illinois Fruit & Produce Co.
(also referred to as IFP Corp.)

Illinois Hydraulic Construction Co.

Illinois School Bus Co., Inc.

Imperial Crane Services, Inc.

Inland Broaching & Tool Co.

Inland Container Corporation

* Interstate Truck Repair

Jack Gray Transport, Inc.

Jacob Twins - Twin Buick, Inc.

Janesville Auto Transport Co.

Jensen Standard Service

Jim Link Chevrolet, Inc.

Jim's Automotive Clinic

Joe Madden Ford

Joe's Automotive Service

KID, Inc.

Kelly-Kean Nissan, Inc.

Kickert School Bus Lines, Inc.

King Transmission Company

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Knaack Manufacturing Company

Knopf's Marathon

Krage's Tire

Krueger Pontiac

Krueger-Ringier

L. Neill Cartage Company, Inc.

LaSalle Rolling Mills

* Lakone Company (The)

Laurel Motors, Inc.

Leaseway Trucking

* Lenz Oil Service of Peoria, Inc.

Les Jones Automotive

* Lever Brothers Company
(for Shedd Food Products)

Levin Tire Center, Inc.

Lewis University

Limbaugh Service

Lynn Chevrolet-Buick, Inc.

M.F.C.H., Inc.

May Department Stores Company (The)

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

McAllister Equipment Co.

McGill Manufacturing Co.

McHenry FS, Inc.

Metropolitan Pump Co.

Meyer Cartage

Miltran, Inc.

Monarch Air Service, Inc.

Moretrench American Corp. Lever

* Murphy Motor Express, Inc.

* Nabisco Brands, Inc.
(a/k/a Nabisco, Inc.)

* Naperville Area Recycling Center, Inc.

* National Generator & Starter

Nationwide Beef, Inc.

Northern Illinois Gas

* Northern Indiana Public Service Co.

Oak Lawn Chrysler Plymouth

* Oberweis Dairy, Inc.
(f/k/a Oatman Bros.)

Owens-Illinois, Inc.

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Packey Webb Ford

Park Service Station

Pat's Automotive Repair

Patrick Motors, Inc.

Patten Industries, Inc.
(including Translift, Inc.)

Pennzoil Company

Pepsi Cola General Bottlers, Inc.

Philadelphia Gear Corp.

Plainfield Stamping-Illinois Inc.
(formerly Plainfield Tool & Engineering, Inc.)

Plainfield Super Value, Inc.

Quanex (LaSalle Steel)

RMT Inc.

Railway & Industrial Services, Inc.

Regency Ford Mercury, Inc.

Reliance Tool & Mfg. Co.

Roadway Express Inc.

Robert Gautschy
(d/b/a Bob's Sunoco Service)

Rogers Cartage Co.

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

* Romines Standard Plaza & Truck

Ruan Leasing, Inc.

Ruan, Inc.

Rusk Aviation, Inc.

S.P. Bradley Motor Company

Sanford Corporation

Schappe Pontiac, Inc.

* Schien Body and Equipment Co.

Schmerler Ford, Inc.

* Shirley Kean

* Siebert Trucking Service

Star Disposal Service Co.

Stocker Hinge Mfg. Co.

Suburban Buick Company

Sullair Corp.

Thom Gravel & Excavating, Inc.

Thompson-Hayward Chemical Co.

Tinley Auto Repair & Towing

Tony Piet Motor Sales, Inc.

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Union Special Corp.

Uniroyal Goodrich Tire Company

United Specialists

Vaia Inc. Auto Specialists

Valley View Community Unit School District No. 365U

Valley Volkswagon, Inc.

Vidmar Buick Company, Inc.

Wadsworth Golf Construction Co. of the Midwest

Walker-Scherk International Inc.

Waspi Trucking, Inc.

* Waste Transfer
(a Division of Waste Management of Illinois, Inc.)

Wes Clark
(d/b/a Wes' Union 76)

Westlake Import Motors, Inc.

Winfield Amoco Inc.
(f/k/a Four Star Automotive Service)

Woodland Landfill
(a Division of Waste Management of Illinois, Inc.)

* Yorktown Firestone
(d/b/a GBA Firestone)

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TABLE 2-1

LENZ OIL SETTLING RESPONDENTS
(continued)

Zayre Corp.

Ziebert Transportation Co.

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* The asterisk indicates a Respondent that was not a party to the initial Judicial Consent Decree with the Illinois Environmental Protection Agency.

TABLE 3-1
PROJECT-REQUIRED ACCURACY AND PRECISION
OF FIELD INSTRUMENTS

	Accuracy		Precision	
	PR	EC	PR	EC
pH	±0.10pH	±0.01pH	±0.10pH	Not Specified
Specific Conductance	±5.0%	±3.0%	±5.0%	Not Specified
Temperature	±1.0%	±0.6%	±1.0°C	Not Specified

Notes:

PR = Project Required
EC = Estimated instrument capability

TABLE 3-2

PROJECT-REQUIRED PRECISION AND ACCURACY REQUIREMENTS FOR LABORATORY ANALYSES

Parameter	Accuracy (percent)	Precision (percent)
TCL Volatiles	CLP	CLP
TCL Semivolatiles	CLP	CLP
TCL PCBs/Pesticides	CLP	CLP
TAL Dissolved Metals	CLP	CLP
TAL Cyanide	CLP	CLP
TCLP Extract Analysis (Metals)	CLP	CLP
Soil Gas Volatiles	75-125	0-20
TOC	75-125	0-20
Particle Size	N/A	N/A
Total Porosity	N/A	N/A

Notes:

"CLP" means the accuracy and precision requirements will be those specified in the appropriate CLP SOW.

"N/A" means that precision and accuracy requirements are not applicable to the specified laboratory analysis.

TABLE 10-1

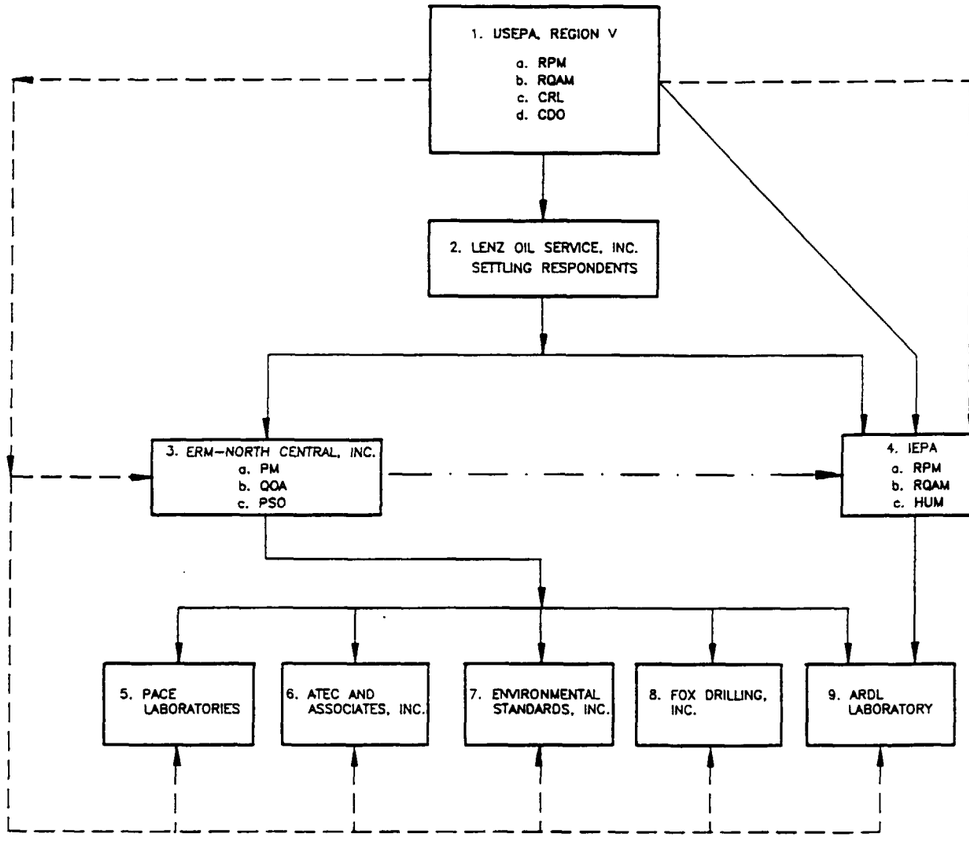
SUMMARY OF LABORATORY PERFORMANCE AND SYSTEM AUDITS

Laboratory	Audit Type	Audit Frequency	Auditor
PACE	Internal Lab Procedure Audits	Semiannually	Lab QAO
	WS/WP PES	Not Specified	USEPA
	State Certification	Not Specified	Not Specified
ARDL	Internal Lab Procedure Audit	Semiannually	Lab QAO
	Blind QC Samples	Not specified	Lab QAO
	Certification	Annually	IEPA
	Certification	Semiannually	OWRB
	Certification	1/1.5 years	USACE
	WS/WP PES	Not Specified	USEPA
ATEC	Internal Lab Procedure	Semiannually	Lab QAO

Notes:

OWRB = Oklahoma Water Resources Board
USACE = U.S. Army Corps of Engineers

FIGURES



NOTE: THIS IS A CONTRACTUAL PROJECT ORGANIZATION CHART AND A QUALITY CONTROL ORGANIZATION CHART. INFORMATION WILL FLOW UP THE ORGANIZATION CHART.

NOTES:

1. U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION V
   a. REMEDIAL PROJECT MANAGER (RPM): NAN GOWDA, P.E.
      – GENERAL PROJECT OVERSIGHT, APPROVE WORK PLAN AND REPORTS.
   b. REGIONAL QUALITY ASSURANCE MANAGER (RQAM): VALERIE J. JONES
      – APPROVE QAPP AND REVIEW ANALYTICAL DATA.
   c. CENTRAL REGIONAL LABORATORY (CRL)
      – CONDUCT PERFORMANCE AND SYSTEM AUDITS OF PROJECT LABORATORIES AND FIELD ACTIVITIES.
   d. CENTRAL DISTRICT OFFICE (CDO)
      – CONDUCT PERFORMANCE AND SYSTEM AUDITS OF FIELD ACTIVITIES.
2. LENZ OIL SERVICE, INC. SETTLING RESPONDENTS.
   COMMON COUNSEL: MARK FURSE; KATTEN, MUCHIN & ZAVIS.
   – COMPLY WITH ADMINISTRATIVE ORDER, DATED NOVEMBER 23, 1989.
3. ERM–NORTH CENTRAL, INC.
   a. PROJECT MANAGER (PM): JOHN IMSE, P.G.
      – DEVELOPMENT, IMPLEMENTATION AND COORDINATION OF RI/FS, MAINTAIN EVIDENCE FILES.
   b. QUALITY ASSURANCE OFFICER (QAO): DOUG ANDERSON, P.E.
      – GENERAL OVERSIGHT OF QA PROGRAM, CONDUCT QA AUDITS OF ERM ACTIVITIES.
   c. PROJECT SAFETY OFFICER (PSO): DAVID BARON
      – ENSURE ALL ON–SITE PERSONNEL COMPLY WITH THE HEALTH AND SAFETY PLAN.
4. ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)
   a. REMEDIAL PROJECT MANAGER (RPM): DAVID DOLLINS
      – GENERAL PROJECT OVERSIGHT; AND DEVELOPMENT, IMPLEMENTATION AND COORDINATION OF ON–SITE SOIL, SEDIMENT, AND SURFACE WATER INVESTIGATION.
   b. QUALITY ASSURANCE OFFICER (QAO): JAMES G. SHAW
      – GENERAL OVERSIGHT OF QA PROGRAM FOR ON–SITE SOIL, SEDIMENT, AND SURFACE WATER INVESTIGATION; CONDUCT QA AUDITS OF IEPA ACTIVITIES.
   c. HYDROGEOLOGY UNIT MANAGER (HUM): SHERRY OTTO
      – OVERSEE IMPLEMENTATION OF ON–SITE SOIL, SEDIMENT, AND SURFACE WATER SAMPLE COLLECTION, ANALYSIS, DATA VALIDATION, DATA ASSESSMENT AND DRILLING ACTIVITIES.
5. PACE LABORATORIES
   LABORATORY DIRECTOR: BRUCE RORHBACH
   – COORDINATE AND OVERSEE LABORATORY ANALYTICAL WORK AND INTERNAL QA AUDITS.
6. ATEC AND ASSOCIATES, INC.
   LABORATORY MANAGER: GORDON PICKETT
   – COORDINATE AND OVERSEE SOIL TESTING WORK AND INTERNAL QA AUDITS.
7. ENVIRONMENTAL STANDARDS, INC.
   PROJECT MANAGER: R.J. VITALE
   – REVIEW QAPP; CONDUCT DATA VALIDATION OF ERM GENERATED DATA, ASSIST IN OVERSIGHT OF ANALYTICAL QA PROGRAM.
8. FOX DRILLING, INC.
   PROJECT MANAGER: G.W. FOX
   – COORDINATE OFF–SITE DRILLING AND INSTALLATION OF MONITORING WELLS.
9. ARDL LABORATORY
   LABORATORY MANAGER: RICHARD L. CURTIN.
   – COORDINATE AND OVERSEE LABORATORY ANALYTICAL WORK AND INTERNAL QA AUDITS.

SYMBOL LEGEND:	
——→	INDICATES CONTRACTUAL OBLIGATION
– – →	INDICATES QUALITY CONTROL RESPONSIBILITY
– · →	INDICATES NONCONTRACTUAL, BUT FUNCTIONAL OBLIGATION

LENZ OIL SERVICE, INC. PROJECT ORGANIZATION AND RESPONSIBILITY CHART	FIGURE 2–1
ERM–North Central, Inc. Deerfield, IL 60015 (708) 940–7200	9292 1/18/91 MTH–

FIGURE 5-1
CHAIN-OF-CUSTODY RECORD

ERM-North Central, Inc.

Sample Chain of Custody

W.O.No.:	Project Name:					Number of Containers							
Sampler:													
ERM Sample Number	Date	Time	COMP	GRAB	Station Location								Remarks

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer

COPIES: White & Yellow copies accompany sample shipment to laboratory. Yellow copy retained by laboratory. White copy to be returned to ERM for files. Pink copy retained by sampler. Gold copy extra copy as needed

FIGURE 13-1

CORRECTIVE ACTION FORM

Date: _____ Activity: _____

Problem/Question reported by: _____

Sample Number(s): _____

Description of Problem: _____

_____

_____

_____

_____

_____

_____

_____

Summary of Corrective Action(s): _____

_____

_____

_____

_____

_____

_____

_____

Is this a recurring problem? _____

Should SOP be modified or updated?: _____

Approval of Lab or Field PM or QAO: _____

Distribution: (check all that are appropriate)

ERM-NC	PM _____	USEPA RPM	_____
ERM-NC	QAO _____	USEPA QAO	_____
ARDL	QAO _____	IEPA PM	_____
PACE	QAO _____	IEPA QAO	_____
		ATEC QAO	_____

APPENDIX A
DETERMINATION OF PROJECT-REQUIRED DETECTION LIMITS FOR SOIL GAS

DETERMINATION OF PROJECT-REQUIRED DETECTION LIMITS FOR SOIL GAS

The objective of the soil gas investigation is to estimate the extent and migration direction of ground water contamination, if any, associated with the Lenz Oil Site. This will be accomplished by measuring the concentrations in shallow soil gas of selected volatile contaminants that may have diffused from an underlying ground water contamination plume. The soil gas results will be used to help direct the placement of monitoring wells along the margins of the ground water contaminant plume. Because some of the monitoring wells will be used to define the lateral extent of the contaminant plume, the soil gas analysis should be as sensitive as the ground water analysis (i.e., the soil gas detection limits should correspond with the ground water detection limits).

To calculate the project-required detection limits for soil gas, the ground water detection limits have been corrected using Henry's Law Constant and the conversion factor for expressing concentration in parts per million by volume (ppmV). Based on Henry's Law, the relationship between the concentrations of a compound in soil gas and ground water can be expressed as:

$$C_{sg} = C_{gw} \times H$$

Where:

C_{SG} = concentration of compound in soil gas, mg/l

C_{GW}= concentration of compound in ground water, mg/l

$$H = \text{Henry's Law Constant (dimensionless)} = \frac{V_p \times MW}{S \times R \times T}$$

Where:

V_p = vapor pressure of compound, mm Hg

MW = molecular weight of compound, g/gmole

S = solubility of compound at 25°C, g/cm^3

R = gas law constant = 62,361 mm Hg x cm^3/gmole x °K

T = standard temperature = 298°K

The data and calculations of soil gas detection limits, which correspond with the ground water detection limits, are presented on Table A-1. Because the estimated laboratory detection limits and reported detection limits are given in units of ppmV, the detection limits were converted from units of mg/l to ppmV.

TABLE A-1

CALCULATIONS OF PROJECT-REQUIRED DETECTION LIMITS FOR SOIL GAS

Compound	C_{GW} (1) (mg/l)	MW (2) (g/gmole)	Vp (2) (mm Hg)	S (2) (ug/l)	H (3) (dimensionless)	PRDL (C_{sg})(4) (mg/l)	Conversion Factor (5) (ppmV/mg/l)	PRDL (C_{sg}) (6) (ppmV)
1,2-dichloroethane	0.005	99	64.0	8,520,000	0.04	0.0002	240	0.05
1,2-dichloroethene (cis)	0.005	97	208.0	3,500,000	0.31	0.0016	250	0.40
1,2-dichloroethene (trans)	0.005	97	324.0	6,300,000	0.27	0.0013	250	0.33
trichloroethene	0.005	132	57.9	1,100,000	0.37	0.0019	180	0.34
1,1,1-trichloroethane	0.005	133	123.0	4,400,000	0.20	0.0010	180	0.18
toluene	0.005	92.1	28.1	535,000	0.26	0.0013	260	0.34
xylenes (total)	0.005	106	10.0	198,000	0.29	0.0014	230	0.32

NOTES:

(1) Project-required detection limits for ground water (from Table 1-1).

(2) Data from USEPA, "Superfund Public Health Evaluation Manual," 1986.

(3) Calculated from:

$$\text{Henry's Law Constant (dimensionless)} = \frac{(\text{Vapor Pressure, mm Hg}) \times (\text{Molecular weight, g/gmole}) \times (1{,}000{,}000 \text{ ug/g}) \times (1{,}000 \text{ cm}^3/\text{l})}{(\text{Temperature, K°})(\text{Solubility, ug/l}) \times (\text{Gas Law Constant, mm Hg} \times \text{cm}^3/\text{gmole} \times \text{K°})}$$

Where: Gas Law Constant = 62,361 mm Hg x cm^3/gmole x K
Temperature = 298° K

(4) Project-required detection limits for soil gas in mg/l calculated from: $C_{sg} = C_{gw} \times H$

(5) Conversion factors for mg/m^3 to ppmV were obtained from Vershueren, K., "Handbook of Environmental Data on Organic Chemicals," 2nd Edition, 1983 and multiplied by 1000 l/m^3.

(6) Project-required detection limits for soil gas in ppmV. Calculated from:

Concentration in soil gas (ppmV) = (Concentration soil gas, mg/l) x (Conversion Factor, ppmV x mg/L)

APPENDIX B

PACE STANDARD OPERATING PROCEDURES

pace
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THE ASSURANCE OF QUALITY

THE DETERMINATION OF VOLATILE ORGANIC COMPOUNDS IN SOIL GAS

Prepared By:

PACE, Incorporated
1710 Douglas Drive North
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October 15, 1990

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Steven R. Crupi
Laboratory QA Officer

10-15-90
Date

Laboratory Manager

10-15-90
Date

MTHDS193

THE DETERMINATION OF VOLATILE ORGANIC COMPOUNDS IN SOIL GAS

A. Scope and Application

1. This method covers the determination of a number of volatile organic compounds.

2. This is a gas chromatographic method applicable to the determination of compounds in soil gas and outdoor air. The method describes analytical conditions for dual capillary column/dual flame ionization detection which allows for qualitative and quantitative confirmation of results on a single injection.

3. The estimated method detection limit (MDL) for each parameter is listed in Table 1. The MDL for a specific sample may differ from those listed, depending upon the nature of interferences in the sample matrix.

4. Other compounds may also be determined by this method. These compounds include but are not limited to: methylene chloride, 1,1,1-trichlorethane, methyl ethyl ketone, cumene, chlorobenzene, 1,1,2,2-tetrachloroethane, benzene, and methyl isobutyl ketone.

B. Summary of Method

1. Volatile organic compounds are collected on charcoal, desorbed with carbon disulfide, and analyzed by dual capillary column gas chromatography with dual flame ionization detectors. Qualitative identification of the parameters of interest is performed using the retention times from two dissimilar capillary columns. Quantitative analysis is performed using internal standard techniques and extraction efficiency is monitored using a surrogate spike.

C. Interferences

1. Method interferences may be caused by contaminants in solvents, reagents, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the detector outputs. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running laboratory reagent blanks.

2. The use of high purity reagents and solvents helps to minimize interference problems.

3. Matrix interferences may be caused by contaminants that co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source.

D. Safety

1. The toxicity or carcineogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. The laboratory maintains a reference file of material safety data sheets for the analyst's use.

2. Safety glasses should be worn when opening the sealed ends of charcoal tubes to avoid injury to the eyes from glass splinters.

E. Apparatus and Materials

1. A calibrated personal sampling pump whose flow can be determined within ±5% at the recommended flow rate.

2. Charcoal tubes - Presently using charcoal tubes provided by SKE, Inc. (known as NIOSH tubes). These are glass tubes with both ends flame

sealed, 7 cm long with a 6-mm OD and 4-mm ID, containing 2 sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The adsorbing section contains 100 mg of charcoal, and the back-up section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the back-up section. A plug of silylated glass wool is placed in front of the adsorbing section.

3. Two milliliter vials with crimp-on caps which contain Teflon-lined septa.

4. Microliter syringes: 10-microliter for GC injections and 25-microliter and 100-microliter for standard preparation.

5. Pipets for dispensing desorbing solvent.

6. Volumetric flasks - Ten-milliter.

7. Glass tube cutter.

8. Gas chromatograph - An analytical system complete with a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns and gases. The injection port must be designed for split injection (Hewlett Packard 5880A GC or equivalent).

9. Columns for dual capillary analysis:

   a. Fused silica, 15 m X 0.32 mm ID, 1 um film thickness, 5% phenyl, 94% methyl, 1% vinyl silicone bonded phase or equivalent (J&W DB-5 or equivalent).

   b. Fused silica, 15 m X 0.32 mm ID, 1 um film thickness, 14% cyanopropylphenyl bonded phase or equivalent (J&W DB-1701 or equivalent).

c. Both columns are installed in the same injection port using a two-hole graphite ferrule.

10. Two Hewlett-Packard 5880A GC terminals or equivalent.

11. Injections are made with a Hewlett-Packard 7673A autosampler or equivalent. The autosampler is programmed to be rinsed in carbon disulfide between injections.

12. Samples exhibiting matrix interferences that prohibit dual column confirmation will be confirmed using GC/MS analysis.

F. Reagents

1. Carbon disulfide - chromatographic grade

2. Stock standard solutions

a. Prepare approximately 50,000 ug/mL standards by adding 500 uL of each analyte to 10 mL volumetric flasks partially filled with carbon disulfide. Fill the volumetric flasks to the mark and invert three times for proper mixing. Correct concentration for density and purity.

b. Transfer the stock standard solutions to Teflon-sealed screw cap bottles. Store with minimal headspace at -10 to -20°C and protect from light. All standards must be replaced after one month or sooner if comparison with check standards indicates a problem.

3. Secondary dilution standards - Using stock solutions, prepare secondary dilution standards in carbon disulfide that contain the compounds of interest, either singly or mixed together, plus the

surrogate standard. The secondary dilution standards should be prepared at the following concentrations: 1000, 5000, and 10,000 ug/mL.

4. Internal standard solution - Prepare a 5000 ug/mL solution of bromofluorobenzene in carbon disulfide as described in Section 6.2. The addition of 10 uL of this solution to 1 mL of sample or standard is equivalent to 50 ug/mL.

5. Surrogate standard spiking solution - Prepare a 5000 ug/mL solution of decane in carbon disulfide. The addition of 10 uL of this solution to charcoal followed by desorption with 1 mL of carbon disulfide is equivalent to 50 ug/mL.

6. Quality control check sample - Prepare a QC check sample at a concentration of 10,000 ug/mL for each analyte of interest (see Table 1). The addition of 5 uL of this solution to charcoal followed by desorption with 1 mL of carbon disulfide is equivalent to 50 ug/mL. The QC check sample concentrates must be prepared by the laboratory using standards prepared independently from those for calibration.

7. Matrix Spiking Solution - Prepare a matrix spiking solution at a concentration of 5,000 ug/mL for each analyte of interest. The addition of 10 uL of this solution to charcoal followed by desorption with 1 mL of carbon disulfide is equivalent to 50 ug/mL. The matrix spiking solution concentrates must be prepared by the laboratory using standards prepared independently from those used for calibration.

G. Method Detection Limits

Detection limits for each analyte are based on the lowest point of the calibration curve (5 ug/mL). Assuming standard temperature and pressure, a sample volume of 25L, the detection limit is calculated using

$$\text{Concentration (ppm in air)} = \frac{(5\ \text{ug/mL})\ (1\ \text{mL})\ (24.45)}{(25\text{L})\ (\text{Mol. Weight})}$$

H. Calibration

1. Establish the following gas chromatographic operating conditions:

Initial column temperature - 40°C,
hold for 5 minutes,
ramp at 20°C/minute to 220°c,
carrier gas-helium at 3 mLs/min. split ratio - 1:5
Detectors - dual flame ionization at 250°C
Injector temperature - 205°C

2. Internal Standard Calibration Procedure

a. Prepare calibration standards so that the addition of 5-10 uL of the standard solution to charcoal and desorption with 1 mL of carbon disulfide spans the expected range of sample concentrations (5, 10, 50, 100, and 500 ug/mL) for each compound of interest plus the surrogate spike compound. After desorption, add 10 uL of bromofluorobenzene (I.S.). The internal standard concentration is 50 ug/mL in the desorbed standard.

b. Inject 1.0 uL into the GC system, analyze according to Section 7.1 and tabulate peak area against concentration for each compound and internal standard. Calculate response factors for each compound using Equation 1.

Equation 1

$$RF = \frac{(A_S)(C_{IS})}{(A_{IS})(C_S)}$$

Where:

A_S = area for the parameter of interest
A_{IS} = area for the internal standard
C_S = concentration of the parameter of interest (ug/mL)
C_{IS} = concentration of the internal standard (ug/mL)

If the RF value over the working range is a constant (<30% RSD), the RF can be assumed to be invariant and the average RF can be used for calculations. The RF corrects the desorption efficiency for each compound of interest.

3. The working calibration curve (or RF) must be verified every 12 hour period by the measurement of a 50 ug/mL calibration standard. Calculate the % difference for each compound using Equation 2.

Equation 1

$$\%D = \frac{RF_{IC} - RF_C}{RF_{IC}} \times 100$$

Where:

RF_{IC} = response factor from the initial calibration
RF_C = current response factor

If the %D for any parameter is greater than ±25%, a new calibration curve must be prepared.

I. Quality Control

1. Before processing any samples, the analyst must analyze a laboratory reagent blank (carbon disulfide) to demonstrate that interferences from the analytical system are under control. Each time a set of samples is desorbed, a laboratory reagent blank must be processed. The reagent blank must contain less than or equal to the MDL of any analyte of interest.

2. Before processing any samples, the analyst must analyze a charcoal tube from the same lot as the sample tubes for a method blank to demonstrate that interferences from the analytical system or charcoal tube are under control. The method blank must contain less than or equal to the MDL of any analyte of interest before any tube can be used for sampling. Each time a set of samples is desorbed, a method blank must be processed.

3. The laboratory must spike in duplicate a minimum of 10% of all samples with the analytes of interest (see 1.1). Samples designated for spiking will be collected in triplicate (i.e., three tubes at the same location). The amount of matrix spike solution added will be based on the sample concentration.

4. The laboratory must demonstrate that the operation of the measurement system is in control by analyzing a quality control continuing calibration sample at the 50 ug/mL level every or every 12 hours. The quality control sample will be prepared from a source other than the calibration standards.

5. The surrogate spike recoveries, the matrix spike recoveries, and the quality control sample recoveries must agree within ±25% of the true values. Precision is determined by calculating the relative percent difference (RPD) of the matrix spike and matrix spike duplicate recoveries for each analyte. The precision action limit is 20%.

J. Sampling

1. Technique

a. Immediately before sampling, break the ends of the tube to provide an opening at least on-half the internal diameter of the tube (2 mm).

b. The smaller section of charcoal is used as a backup and should be positioned nearest the sampling pump.

c. Connect two charcoal tubes in series in order to distinguish breakthrough from migration.

d. Do not exceed the recommended air volume of 25 L.

e. The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

f. One tube should be handled in the same manner as the sample tube (break, seal and transport) except that no air is sampled through this tube. This tube should be labeled as a travel blank and be treated as a regular sample. Results for travel blanks will be submitted with samples.

g. Label as primary and secondary tube.

2. All samples must be iced or refrigerated at 4°C from the time collection until desorption.

3. All samples must be analyzed within 14 days of collection.

K. Sample Desorption

1. The status of the seals on each charcoal tube is noted and recorded as intact, broken, or none.

2. The field identification number and the laboratory identification number on each sample seal are checked with those on the sample identification sheets.

3. Remove front and back charcoal sections from each primary tube and place in separate sample vials.

4. Add 10 uL of surrogate spiking solution to each sample, blank or standard.

5. One milliliter of the desorbing solvent is dispensed into each sample vial. The vial is immediately sealed. Each vial is swirled for 20 minutes to aid the desorption process.

L. Gas Chromatography

1. Section H.1 summarizes the recommended operating conditions for the gas chromatograph. Table 1 contains retention times from the two capillary columns.

2. Calibrate the system daily as described in Section H.

3. The internal standard must be added to the sample extract and mixed thoroughly immediately before injection into the gas chromatograph.

4. Inject 1 uL of the sample extract or standard into the gas chromatograph. Record the volume injected, the total extract volume, and the resulting peak size in area or peak height units.

5. Identify the parameters in the sample by comparing the retention times of the peaks in the sample chromatogram with the peaks in the standard chromatograms. The width of the retention time window used to make identifications is the mean retention time window from the initial calibration ± three standard deviations. Daily adjustments to the retention time window will be made based on the retention time of the daily calibration standard ± three standard deviations as determined during initial calibration.

6. If the response for a peak exceeds the working range of the system for any compound of interest, dilute the extract and reanalyze.

7. If there are other non-target peaks present with responses greater than 10% of the internal standard, tentatively identify using retention time indexes.

M. Calculations

1. Determine the concentration of individual compounds in the front and back sections of the charcoal tube.

2. Calculate the concentration in air by the following equation:

$$\text{Concentration (mg/cubic meter)} = \frac{(A_S)\ (C_{IS})\ X\ 1\ ML}{(A_{IS})\ (RF)\ \ (V)}$$

X 0.001 mg/ug X1000L/cubic meter

where: A_S = area for the parameter of interest

A_{IS} = area for the internal standard

C_{IS} = concentration of the internal standard (ug/ml)

RF = average response factor for the parameter of interest

V = air volume sampled, in liters

1ML = volume of desorption solvent

$$\text{Concentration (ppm in air)} = \text{Concentration (mg/cubic meter)} \frac{X\ 24.45\ X\ 760\ X\ (T + 273)}{MW\ \ X\ P\ X\ \ 298}$$

where: MW = molecular weight of the parameter of interest

P = pressure (mm Hg) of air sample

T = temperature (°C) of air sample

760 = standard pressure (mm Hg)

298 = standard temperature (°K)

24.45 = molar volume (liter/mole) at 25°C and 760 mm Hg.

3. If the back section of the charcoal tube contains compounds of interest at greater than 25% of the front section, the second tube must also be analyzed.

4. Calculate the concentrations in air of non-target peaks by setting the response factor for the non-target peak equal to the response factor for the internal standard, use a MW equal to 100, and assume the desorption efficiency equals 100%.

N. Data Validating and Reporting

Data will be validated prior to report submittal to ERM-North Central. Minimal validation procedures include:

- Checking Calculations
- QC Data Review
  - Holding Times
  - Blank Data
  - Matrix Spike Data
  - Duplicate Data
  - Reference Standard Data
  - Acceptance Criteria Evaluation
- Check for Transmittal Errors

Following data validation, a final report will be printed and sent to ERM-North Central. This report will contain sample and QC results which will include any blanks analyzed with the samples, surrogate and matrix spike/matrix spike duplicate recoveries.

O. References

1. "NIOSH Manual of Analytical Method," ed. 2 Vol. 1-4, National Institute of Occupational Safety and Health, U.S. Government Printing Office, Washington, D.C. (1977-78).

2. "NIOSH Manual of Analytical Method," ed. 3 Vol. 1-2, U.S. Department of Health and Human Services, U.S. Government Printing Office, Washington, D.C. Publication No. 84-100, 1984.

3. "Statement of Work for Organic Analysis", USEPA, 10/86, Rev: 7/87.

4. Code of Federal Regulations, 40 CFR 136, Appendix A, July 1, 1987.

TABLE 1

Target Compounds

Parameter	MDL (1) (ppm in air)	Desorption Efficiency	Column 1 DB-5	Column 2 DB-1701
cis-1,2-Dichloroethene	0.05	1.03	1.32	1.50
trans-1,2-Dichloroethene	0.05	1.03	1.76	2.26
1,2-dichloroethane	0.05	*	*	*
Trichloroethene	0.04	0.93	3.31	3.66
1,1,1-Trichloroethane	0.04	*	2.30	2.39
Toluene	0.05	0.90	5.52	5.98
M,P-Xylenes (total)	0.05	0.99	7.70	7 89
O-Xylene	0.05	0.97	8.05	8.30
Bromofluorobenzene (IS)	----	----	8.48	8.90
Decane (SS)	----	*	*	*

* To be determined
Column 1 - DB-5
Column 2 - DB-1701
(1) Based on a sample size of 25 L, standard temperature and pressure, 1 mL desorption volume, and low calibration standard (5 ug/mL).
IS = Internal Standard
SS = Surrogate Standard

SAMPLE CUSTODY

A. Chain of Custody

Chain-of-Custody will be initiated in the field at the time of sample collection and will clearly document specific sample preservation/containers used. Any special considerations associated with sample acquisition will also be documented.

In addition to chain of custody records, all samples collected in the field are labelled in such a manner that the client, sample identification, sampling data and time, sampler, analyses to be performed, preservative and sample custodian are documented. Information documented on sample labels should correlate exactly to chain of custody records. The samples will be delivered to the contracted laboratory by UPS overnight delivery. Sample preservation must be maintained until analyses.

B. Control of Incoming Samples

PACE has a designated sample custodian whose primary responsibility is to document receipt of samples, initiate the appropriate log-in procedures described below, assure proper documentation and prompt analyses of the samples. The sample custodian also maintains proper custody of samples and analytical data to verify the integrity of reports submitted to our clients.

When samples are received at the laboratory accompanied by a chain of custody form, the sample custodian will initiate the following steps:

1. Verify that each sample was in the packing container as recorded on the Chain of Custody record.

2. Document on the Chain of Custody form any breaking of seal of sample bottles which may have occurred during transport to the laboratory.
3. Sign and date the "received at laboratory by" box. The exact number of sample containers received by the laboratory is recorded for each sample.
4. Enter into the Lab Data Management System (LDMS) all pertinent information about the client, sample collection, sample matrix, analyses to be performed and number of bottles received.

All samples received by PACE are identified and labeled showing the name of the client, sample location or code, date received and the preservative added to the bottle (Figure VI-2). Samples are entered into the log book which contains the following:

a. A number assigned to each sample. Numbers begin with 1 on the first day of the year.
b. Identification of the client name.
c. Date the sample was received at the laboratory.
d. Number of bottles received for each sample.
e. Initials of person who checked in samples.

To complete the sample and analysis data entry procedure, a copy of the information entered into the LDMS is generated and attached to any other information about the project. Before samples are stored, they are rechecked to make sure they are in the correct container and are properly preserved.

C. Maintenance of Custody and Sample Storage

PACE has implemented standard operating procedures to assure the integrity of both samples and data so that they are not degraded or

disclosed to unauthorized personnel. In order to insure that this policy is maintained, the laboratory facilities are under controlled access. Only employees of PACE Laboratories, Inc. are allowed access to the laboratory facilities. Visitors must register at the front desk. Visitors are accompanied at all times when in the laboratory by an employee of PACE. The building is locked and secured at the end of each working day. Keys to the building are issued only to select personnel.

Samples are stored either in a large walk-in cooler at 4°C, at room temperature, or in a ventilated hazardous waste room. All sample storage areas have locks and are secured at the end of each working day by the sample custodian.

Samples are removed from their proper storage location by the analyst and are returned to the storage area immediately after the required sample volume has been taken. This minimizes unnecessary time spent searching for samples and helps prevent matrix degradation from prolonged exposure to room temperature.

For samples involving a high degree of confidentiality or potential litigation, PACE, Inc. has developed extensive sample and data handling protocols to assure the scientific and legal defensibility of the report submitted.

The laboratory will hold the sample extracts for 365 days and the remaining sample for 90 days. At the end of these holding times, the laboratory will properly dispose of the extracts or samples.

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01207

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client

Address

Phone

Report To:

Bill To:

P.O. # / Billing Reference

Project Name / No.

Pace Client No.

Pace Project Manager

Pace Project No.

*Requested Due Date:

Sampled By (PRINT):

Sampler Signature

Date Sampled

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA			ANALYSES REQUEST	REMARKS
1													
2													
3													
4													
5													
6													
7													
8													

Figure VI-1
CHAIN OF CUSTODY

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE

Additional Comments

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME

Figure VI-2
SAMPLE LABEL

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 812-544-5543

Client: _____

Sample Description: _____

Date Collected: _____ Received: _____

Collected by: _____ Time: _____

Analysis: _____

Preservative: ☐ None ☐ HNO_3 ☐ H_2SO_4 ☐NaOH

☐ Acetone Rinse ☐ HCl Other: _____

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 812-544-5543

Client: _____

Sample Description: _____

Date Collected: _____ Received: _____

Collected by: _____ Time: _____

Analysis: _____

Preservative: ☐ None ☐ HNO_3 ☐ H_2SO_4 ☐NaOH

☐ Acetone Rinse ☐ HCl Other: _____

PREVENTIVE MAINTENANCE PROCEDURES

The data generated from any test performed on an instrument depends on the inherent accuracy and proper operation, use and function of the instrument itself.

It is essential that the instruments in the laboratory operate under optimum conditions at all times. Local service personnel are available on an on-call basis. The laboratory staff must be familiar with the manufacturer's operating manual for each instrument and routinely perform various service checks. Formalized preventive maintenance contracts have been executed with outside vendors.

Preventive maintenance of laboratory instruments will be consistent with the Statements of Work and Table XIII-1.

Proper operation of field instruments will be ensured through calibration and routine system checks. Field instruments will be calibrated at the start of each day. This calibration will take place prior to field use. At this time, a routine equipment check will be performed to ensure proper operation. Information related to calibration and operation will be recorded in the field instrument operation log book. If instrument operation is questionable, a new instrument will be immediately substituted and the faulty instrument will be returned to the office for maintenance.

Field instruments will be recalibrated following field use. Calibration information will be recorded in the field instrument operation log book.

TABLE XIII-1 PREVENTIVE MAINTENANCE MINIMUM SCHEDULE

:em	Maintenance Performed	Frequency
?efrigerators	Temperature checked & logged	Daily
ilk-in Coolers	Temperature checked & logged	Daily
?alances	Calibration	Daily, when in use
	Service representative calibration	Annually
)eionized/Organopure Water	Conductivity check	Daily
	Ion exchange beg changed	Weekly
	Replace filters	As needed
'acuum Pumps & Air Compressor	Check performance	Weekly
	Lubrication, belts, etc.	As needed
Conductivity Meter	Calibrate with standard KCl	Daily, when in use
H Meter	Calibrate, check electrode	Daily, when in use
tomic Absorption (Flame & Flameless)	Check standard calibration	Daily, when in use
	Clean nebulizer	Daily
	Clean unit housing	As required
	Manufacturer's representative preventive maintenance inspection	Annually
JV-Visible ?ectrophotometer	Clean unit housing	Weekly
	Calibration	Daily
	Preventive maintenance check	Monthly
?s Chromatographs	Calibration/response verification	Daily
	Septa change	Every 35 samples
	Repack, change column	When calibration criteria are not met
	EC (Ni-63) wipe test	Semi-annually
	Other preventive maintenance	As needed
GC/MS	Data system preventive maintenance by Manufacturer	Semi-annually
	Source cleaning	Frequency determined by performance
	Septa changed	Daily
	Injection port liner checked	Daily
	Column maintenance	As needed
ICAP	Check nebulizer aspiration hose	Daily
	Aspiration date verification	Daily
	Check standard calibration	Daily
	ICAP Torch Cleaning	Monthly
	Manufacturers representative Preventive Maintenance Check	Annually

CORRECTIVE ACTION

Should sampling or analytical systems be shown to be unsatisfactory, a corrective action will be implemented. If previously reported data are affected by the situation requiring correction, or if the corrective action will impact the project budget or schedule, the ERM Project Manager should also be directly involved in the corrective action decision.

A. Overview

Corrective action is required when work does not conform with project requirements or work procedures specified in the QAPP. Nonconformance activities shall be documented, and the documentation shall include the following:

- Name(s) of the individual(s) identifying the nonconformance.
- Description of the nonconformance.
- Any required approval signatures.
- Development of an appropriate corrective action.
- The corrective action taken or an explanation for not initiating a corrective action.
- Schedule for implementation and completion of the corrective action.

If a nonconformance is detected, the ERM Project Manager will immediately notify the USEPA Region V Project Coordinator verbally and in writing. The notification will include the corrective action

taken or planned. Further, the ERM Project Manager will also inform the USEPA Region V Project Coordinator of the completion of the correction actions taken and provide an evaluation of the results of the action.

B. Field Correction Action

Field audits conducted by the Project Manager, or those appointed by the Project Manager, may yield results that do not satisfy the QA objectives of the project. The ERM Project Manager will inform the USEPA Region V Project Coordinator of the nonconformity. The ERM Project Manager will present a plan for correction of the nonconformity. Following acceptance of the plan, the ERM Project Manager will be responsible for implementation of the correction action.

Corrective actions may range from altering solvent washes used in decontamination to changing the sampling strategy to obtain representative samples. The ERM Project Manager has the ability to stop all work if audit results warrant such action.

The plan for corrective action will depend upon the nonconformity encountered. Development of the corrective action will be the responsibility of the ERM Project Manager.

Approval of the plan will be the responsibility of the USEPA Region V Project Coordinator.

C. Laboratory Corrective Action

The laboratory has SOPs for corrective action protocols that are consistent with US EPA requirements. Corrective action must be implemented if unsatisfactory performance and/or system audit results are recorded. Corrective action may also be implemented if the results of a data assessment or internal QC check warrants such action.

For either immediate or long-term corrective actions, laboratory corrective action steps comprising a closed-loop corrective action system are as follows:

1. Definition of the problem.

2. Assignment of responsibility for investigation of the problem.

3. Investigation and determination of the cause, including

   a. Calculations check.
   b. Sample re-analysis.
   c. Standard check.
   d. System calibration check.

4. Determination of a corrective action to eliminate the problem.

5. Assignment and acceptance of responsibility for implementing the corrective action.

6. Establishment of effectiveness of the corrective action and implement the correction.

7. Verification that the corrective action has eliminated the problem.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, corrective action employed, and verification will be documented.

DATA REDUCTION, VALIDATION AND REPORTING

A. Data Reduction

Data generated in the laboratory by each analytical procedure will be reduced to usable chemical concentrations. The SOPs contained in Appendices through contain data reduction discussions.

PACE utilizes a computerized management system to track the progress of sample analysis and organize data generated in the laboratory. Upon receipt of sediment and ground water samples at PACE, all background information pertaining to the project will be entered into the computer.

Analytical data will be appropriately recorded by PACE on parameter/subset specific raw data sheets, which are signed and dated by the analyst and reviewed by a second analyst. The data will then be entered into the computer laboratory information system.

Data generated by PACE will be reported in accordance to the method requirements. The Final Report of Laboratory Analysis will include a summary of quality control results.

B. Data Validation

Analytical data will be recorded during the analysis and the raw data sheets signed and dated by the analyst. This data will be validated by checking calculations and reviewing duplicate data.

Data will be validated in the computer system prior to report printout. Printouts will be spot checked. Minimal validation procedures include:

- Checking holding time and calculations

- QC data review
  - Blank data
  - Matrix spike data
  - Duplicate data
  - Reference standard data
  - Acceptance criteria evaluation

- Check for transmittal errors

Following data validation, a final report will be printed. Reports will be spot checked after printing and routed for final review and signatures. The signed final report will be submitted to ERM - North Central, Inc.

APPENDIX C

STANDARD OPERATING PROCEDURE FOR FIELD AUDITS

STANDARD OPERATING PROCEDURE
FOR
FIELD AUDITS

1. PARAMETER(S) TO BE MEASURED

Quality Assurance (QA) audits of field measurement procedures, sample collection, and sample custody procedures will be performed on a periodic basis by the Quality Assurance Officer (QAO) at ERM-North Central, Inc. (ERM) and/or the Illinois Environmental Protection Agency (IEPA). The audits will be conducted to document that field activities are performed in accordance with the requirements of the Lenz Oil Site RI/FS Sampling and Analysis Plan.

The following areas will be audited:

- Sampling procedures,
- Monitoring well installation,
- Sample preparation and handling,
- Field measurement procedures, and
- Equipment decontamination.

The specific parameters/activities to be measured are described below.

Sampling Procedures

Audits of ground water, soil, sediment, surface water, soil gas, private water well, and air sampling will be conducted to ensure that the procedural requirements described in the Sampling and Analysis Plan are followed.

Monitoring Well Installation

An audit of monitoring well installation activities could include checks to ensure proper continuous sampling, soil classification, aquifer evaluation, screen installation, backfilling, and grouting. The actual items that will be checked for compliance with the requirements of the Sampling and Analysis Plan are dependent on the activities being performed at the time of the audit.

Sample Preparation and Handling

During sample collection, the auditor will check sample preparation and handling procedures to ensure compliance with the requirements of the Sampling and Analysis Plan. These procedures include: 1) sample container filling, (2) collection of duplicate (replicate) samples, (3) filtering, (4) sample preservation, (5) sample container labeling, (6)sample packaging, (7) sample shipment, and (8) chain-of-custody completion.

Field Measurement Procedures

An audit of field measurement procedures could include verification of pH, conductivity, temperature, geologic classification, and HNu screening procedures and accuracy.

Equipment Decontamination

The frequency and extent of equipment decontamination will be verified during audits of field activities. The decontamination procedures must conform to the requirements of the Sampling and Analysis Plan and the Lenz Oil Site RI/FS Health and Safety Plan.

2. RANGE OF MEASUREMENT

The audited activities must meet the performance requirements described in the Sampling and Analysis Plan unless otherwise mutually agreed upon by ERM and IEPA.

3. LIMIT OF DETECTION

The detection limit discussion does not apply to field audit determinations.

4. SAMPLE MATRIX

The sample matrices to be included in field audits are ground water, soil, sediment, surface water, soil gas, and air.

5. PRINCIPLE, SCOPE AND APPLICATION

Field audits for Lenz Oil Site Remedial Investigation (RI) activities will be conducted on a monthly basis to document that field activities are performed in accordance with the requirements of the Sampling and Analysis Plan. The audits will be conducted by the QAO at ERM and/or IEPA.

The results of the field audits will be used to designate areas of inadequate or incorrect performance and the need, if any, of additional or modified activities.

6. INTERFERENCES AND CORRECTIVE ACTIONS

A discussion of interferences does not apply to the field audit description.

Should the QAO determine that any of the audited activities are being performed in a manner that does not comply with the

requirements of the Sampling and Analysis Plan, the problems will be immediately discussed with on-site personnel. In addition, any deviations noted will be relayed to the project managers at ERM and IEPA.

7. SAFETY PRECAUTIONS

The QAO from ERM and/or IEPA will comply with all requirements of the Health and Safety Plan regarding general site safety as well as the specific activities being audited.

8. SAMPLE SIZE, COLLECTION, PRESERVATION, AND HANDLING

This section does not apply.

9. APPARATUS AND MATERIALS

This section does not apply.

10. ROUTINE PREVENTATIVE MAINTENANCE

This section does not apply.

11. REAGENTS AND CALIBRATION STANDARDS

This section does not apply.

12. CALIBRATION PROCEDURES

This section does not apply.

13. SAMPLE PREPARATION

This section does not apply.

14. ANALYTICAL MEASUREMENT

This section does not apply.

15. FLOW CHART OF ACTIVITIES

A flow chart that shows the possible field audit activities is included as Attachment 1 to this Standard Operating Procedure (SOP).

16. DATA TREATMENT

No calculation of information received during the field audit is required.

17. DATA DELIVERABLES

Information obtained during the field audit will be compiled on the audit checklist found in the Sampling and Analysis Plan. Upon completion of the audit, this form will be stored in the Lenz Oil Site files. If any deficiencies or deviations from the requirements of the Sampling and Analysis Plan are noted, these will be verbally transmitted to both ERM and IEPA project managers. In addition, notations describing the auditor, activities audited, necessary corrective action, date, and time will be included in the Lenz Oil Site daily log book.

18. QUALITY CONTROL REQUIREMENTS

To ensure accuracy, quality, and usefulness of the field audit, the QAO will be familiar with the requirements of Lenz Oil Site plans and will have previous experience related to oversight of or participation in field measurement, sample collection, and sample custody procedures.

19. REFERENCES

ERM-North Central, Inc., Lenz Oil Site RI/FS Health and Safety Plan, October 19, 1990.

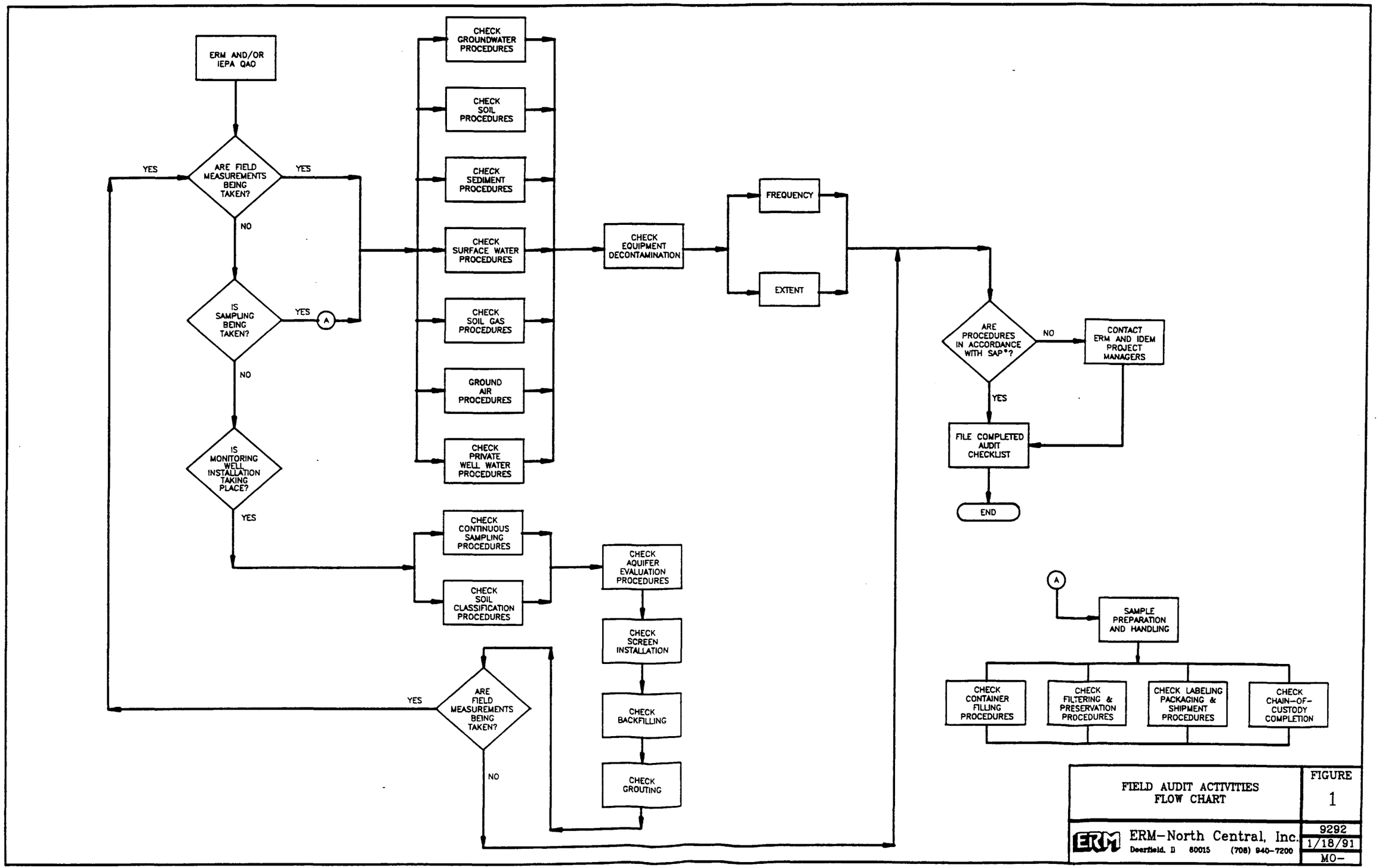
ERM-North Central, Inc., Lenz Oil Site RI/FS Sampling and Analysis Plan, October 19, 1990.

ERM-North Central, Inc., Lenz Oil Site RI/FS Quality Assurance Project Plan, October 19, 1990.

20. METHOD VALIDATION DATA

This section does not apply.

ATTACHMENT C-1



FIELD AUDIT ACTIVITIES FLOW CHART

FIGURE 1

ERM-North Central, Inc.
Deerfield, IL 60015 (708) 940-7200

9292
1/18/91
MO-

APPENDIX D

ARDL STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE
FOR
TCLP EXTRACTION AND METAL ANALYSIS

PREPARED BY:

ARDL, INC.
1801 W. FOREST STREET
MT. VERNON, ILLINOIS 62864

1.0 Principle, Scope and Application

The TCLP is designed to determine the mobility of both organic and inorganic contaminants present in liquid, solid and multiphasic wastes. This SOP deals with characterization of the waste with respect to metals contaminants.

The waste is separated into liquid and solid fractions using the procedures prescribed in 40 CFR 126, Appendix II, as finally promulgated in the Federal Register Volume 55 #126, June 29, 1990. Figure 1 is a block diagram summarizing the procedure. Solid fractions are extracted with one of two specific extraction fluids according to the results of pH measurements made on an aqueous suspension of the solids. Liquid fractions (if any) and the extract of the solid phase are combined if compatible and the resultant solution is analyzed as the TCLP extract. Each phase of multiphasic wastes is treated as a separate sample for purposes of extraction. Methods for calculating volume weighted concentrations of target analytes in multiphasic wastes are given as part of the procedures referenced above.

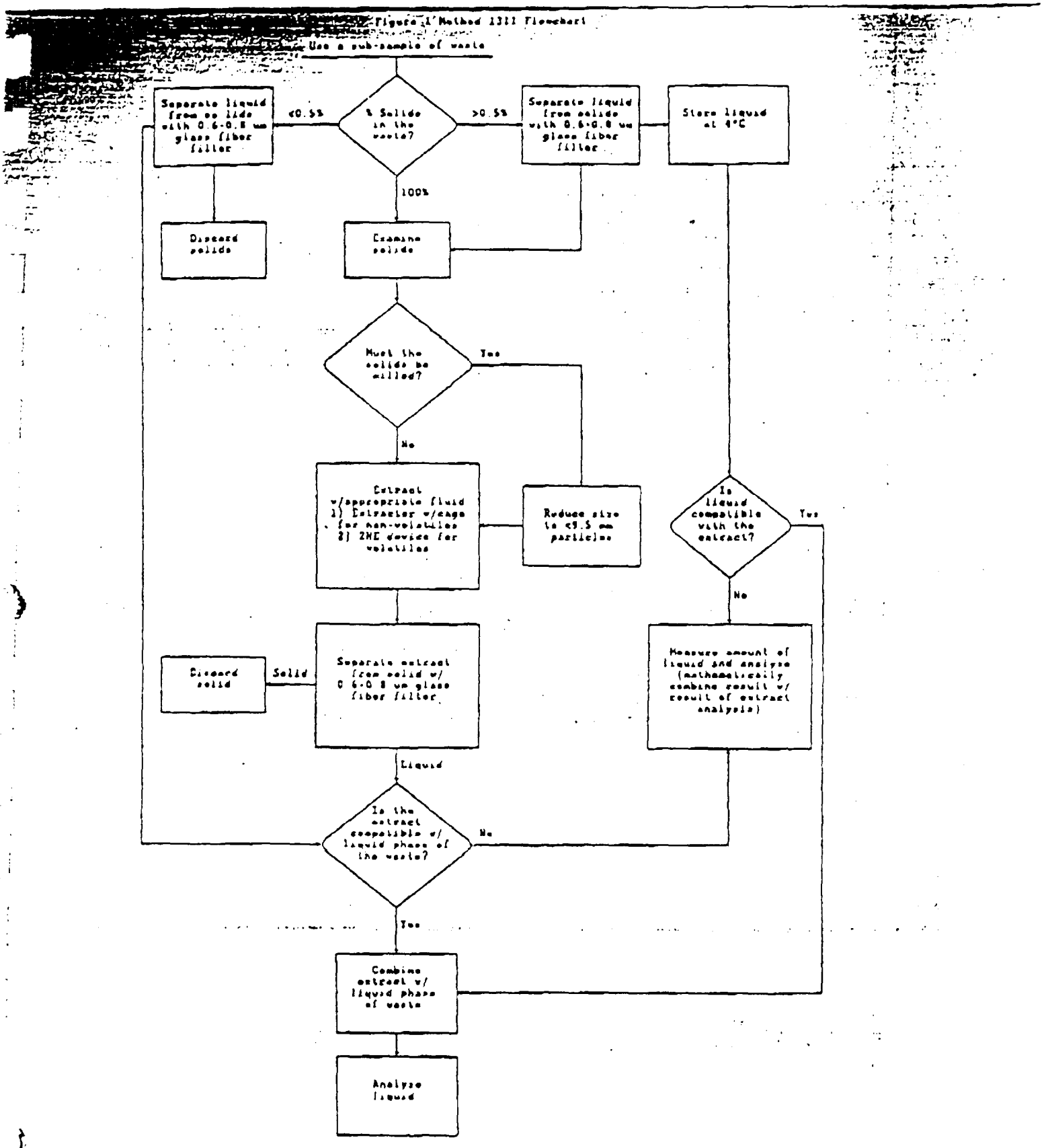
If a total analysis of the waste demonstrates that individual contaminants are not present in the waste or are present at such low levels that regulatory thresholds cannot be exceeded, TCLP is not required.

If a regulated compound is present in any one of the TCLP extract fractions at levels so high that, even after accounting for dilution by the other fractions the regulatory threshold is exceeded, then the waste is hazardous and it is not necessary to analyze the other fractions.

If analysis of the extract obtained from the bottle Oxtractor demonstrates that the concentration of any regulated volatile contaminant exceeds the regulatory threshold then the waste is hazardous and use of the ZHE is not required. Results from analysis of the bottle extractor, however, cannot be used to demonstrate that the concentration of volatile contaminants is below regulatory limits.

2.0 Target Analytes (Metals)

The target metal analytes in TCLP extracts are listed in Table 1.



[Appendix II]

Source: 40 CFR 126, Appendix II

TABLE 1

Detection Limits (mg/L) TCLP Extracts

Analyte*	Soils Solids	Liquids/ Water	Regulatory Limit
Aluminum	0.15	0.075	5.0
Antimony	8.8	0.009	-
Arsenic	0.001	0.0005	-
Barium	0.028	0.014	100
Beryllium	0.004	0.002	-
Cadmium	0.009	0.0045	1.0
Calcium	0.15	0.073	-
Chromium	0.0026	0.0013	5.0
Cobalt	0.028	0.014	-
Copper	0.036	0.018	-
Iron	0.042	0.021	-
Lead	0.0028	0.0014	5.0
Magnesium	0.1	0.05	-
Manganese	0.018	0.0088	-
Mercury	0.0004	0.0002	0.2
Nickel	0.054	0.027	-
Potassium	0.26	0.130	-
Selenium	0.001	0.0005	1.0
Silver	0.018	0.0092	5.0
Sodium	0.24	0.120	-
Thallium	0.004	0.002	-
Vandium	0.040	0.020	-
Zinc	0.032	0.016	-

3.0 Detection Limits (Metals)

Detection limits for analysis of metal analytes in TCLP extracts appear in Table 1. These limits are determined quarterly as described in Section 3.4 of ARDL's QAPP. The applicable portion of that section appears below.

3.4.1.2 DETECTION LIMITS

ARDL will perform and report to the Contract Laboratories Officer quarterly verification of instrument detection limits (IDLs) for each of the metals in pure water. IDLs may need to be verified more frequently if there is a major change in the analytical system. IDLs will be reported by type and model for each instrument used on this contract. IDLs shall only be reported for analytical methods specified in the approved QAPP.

Standard solutions of the analytes of the analytes of interest are prepared in reagent water at a concentration 3-5 times the previous IDL. These solutions are analyzed on three (3) nonconsecutive days with 7 consecutive measurements per day. The new IDL is three times the standard deviation obtained from these analyses.

5.0 Apparatus and Equipment (Metals)

5.1 Sample Preparation/Extraction

Agitation Apparatus: Fabricated in house using conventional materials. Meets all specifications cited in procedures referenced in Section 1.0, above.

Extraction Vessels: Bottle Extractors, borosilicate glass bottles of appropriate volume

Filtration Devices: Millipore Corporation #YT30142HWXX1004700

Laboratory Balance: Fisher Scientific #S-400, or equivalent

Filters: Glass fiber, 0.6-0.8 um pore size. Millipore Corporation #AP40. Filters must be washed prior to use by rinsing with 1 N nitric acid followed by three consecutive rinses (approximately 1 L each) of reagent water. After washing the filters are dried at 105o C and stored in a dessicator until used.

pH Meter: Orion Model 407 with combination electrode (Fisher Scientific #13-620-287) or equivalent system.

5.2 Analytical Instrumentation

The instrumentation employed in analysis of the extractsprepared depends on the method selected for that analysis. See Section x.x, below.

6.0 Reagents (Metals)

Reagent water, meets or exceed ATSM Type II specifications Hydrochloric Acid, 1N. Made by dilution of ACS reagent grade materials.

Sodium Hydroxide, 1N. Made by dilution of ACS reagent grade materials.

Glacial Acetic Acid, ACS Reagent Grade

Extraction Fluids:

Fluid #1: Add 5.7 ml glacial acetic acid to 500 ml of reagent water, add 64.3 ml 1N sodium hydroxide and dilute to a volume of 1.0 L. The pH of the properly prepared solution will be 4.93+/-0.05.

Fluid #2: Dilute 5.7 ml of glacial acetic acid to a volume of 1.0 L with reagent water. The pH of the properly prepared solution will be 2.88+/-0.05.

Analytical standards prepared as specified in the appropriate analytical methods.

7.0 Sample Preservation and Handling (Metals)

Prior to extraction no preservatives are to be added to the samples. They may be refrigerated unless it is expected that refrigeration may result in irreversible physical change. If refrigeration results in precipitation the entire sample and the precipitate must be extracted.

Extracts should be prepared for analysis and analyzed as soon as practicable after receipt. Maximum holding times after collection and before extraction are 28 days and 180 days for mercury and for all other metals, respectively. After extraction the maximum holding times before analysis are 28 days and 180 days for mercury and for all other metals, respectively.

Extracts intended for metals analysis should be preserved to pH less than 2.0 after preliminary testing of a small aliquot to show that no precipitate is formed by preservation. If a precipitate is formed the preservative

is not to be added and analysis of the extract is to proceed as soon as possible. Extracts should be refrigerated (4o C) until analyzed.

Extracts for metals analysis will be digested in accordance with analytical method employed (see Section x.x, below). If regulatory limits for a metal are exceeded on analysis of an undigested extract, the sample is hazardous and analysis of digested extract is not required. Data from an undigested extract cannot be employed to demonstrate that the sample is not hazardous.

8.0 Extraction Procedure (Metals)

The text in this section outlines the instructions contained in the referenced section of the Federal Register. Copies of that document are on file in the laboratory. It is mandatory that all technical personnel read and understand these regulations.

8.1 Preliminary Evaluations

Wastes are characterized to determine: 1) percent solids; 2) whether the waste will act as its own extract; 3) if the solids present require particle size reduction; and 4) the proper fluid to use for extraction. The procedures involved are completely described in Section 7.0 of the referenced document.

8.1.1 Percent Solids Determination

For purposes of this determination percent solids are defined as the fraction of the waste which yields no liquid when filtered under pressure. Some wastes, however, may contain solids which tend to retain significant quantities of the liquid phase under the conditions of the test described below. To screen against these an additional determination of total dry solids is performed when the first value for solids is equal to or greater than 0.5% but less than 5.0%. If the waste obviously contains no liquid phase (i.e. is a dry solid) proceed to Section 8.1.2, below. Otherwise proceed as follows:

Record the weight (F) of a properly prepared glass fiber filter to the nearest 0.01 g and assemble the filtration device.

Record the weights (T1 and T2) of two 250 ml glass beakers to the nearest 0.01 g.

Allow the waste sample to warm to room temperature. Weigh a portion (minimum of 100 g) into beaker T1. Determine the weight of the sample taken (observed weight - T1) and

record the value (S1). Place the other beaker (T2) under the filtration device outlet.

Without rinsing, quantitatively transfer the weighed sample to the filtration device. If a portion of the weighed sample has obviously adhered to the transfer vessel reweigh the vessel and determine the amount of material not transferred (observed weight-T1) and record the value (S2).

Seal the filtration device and gradually apply 1-10 psi of pressure using nitrogen. Maintain the pressure for two minutes or until filtration is complete and the pressurizing gas is passing through the filter. If, after two minutes, there is no filtrate flow or the flow has diminished, increase the filtration pressure by 10 psi. Hold at the new pressure for an additional two minutes until filtration is complete and the pressurizing gas is passing through the filter. If at the end of that interval there is no filtrate flow or the flow is diminished, increase filtration pressure by 10 psi and repeat the procedure above. Continue increasing pressure in 10 psi increments to a maximum of 50 psi until: 1) filtration is complete and the pressurizing gas is passing through the filter; or 2) there is no filtrate flow in a two minute interval.

> NOTE: Some wastes (especially oils, paints, inks, etc.) may appear to be liquids but will not pass through the filter under the conditions of the test. In such cases, the waste is defined as a solid and is extracted as such in the manner described later in this document.

Weigh the beaker containing the filtrate to the nearest 0.01 g and record the weight (F1).

Calculate the percent solids in the sample as follows:

Sample weight taken (S3) = (S1-S2)
Solids Obtained (S4) = S3-(F1-T2)
Percent Solids = (S4 x 100)/S3

If percent solids is less than 0.5% the sample is its own extract. Proceed with analysis as specified in Section 9.0.

If percent solids is greater than 5.0% proceed to Section 8.1.2, below

Quantitatively transfer the filter and solid phase from the filtration apparatus and place on a tared watch glass.

Dry the filter and solids at 100+/-20o C until two successive weighings agree within 1%.

Determine percent dry solids (%TS) as follows:

S = (dry filter+solids+watch glass)-watch glass-F
%TS = (S x 100)/S3

If percent dry solids is less than 0.5% the sample is its own extract. Proceed with analysis as specified in Section 9.0.

If percent solids is equal to or greater than 0.5% proceed to Section 8.1.2, below.

8.1.2 Particle Size Determination

Particle size reduction of the solid phase is required if: 1) surface area of the.solid is less than 3.1 sq. cm. per gram or; 2) the solid will not pass through a 9.5 mm. (U.S. Standard) seive. (NOTE - Surface area criteria are meant to apply to the gross structure of filamentous samples such as cloth, matting, paper, etc. An estimate of this value may be obtained by cutting a 1" square section of the substance and determining its weight to the nearest 0.01 g. If the sample weighs more than 2.08 g the particle size of the sample must be reduced.)

If the particle size of the solid phase does not meet these criteria it must be ground (mortar and pestle), chopped (Wiley mill) or cut (scalpel, knife or scissors) to acceptable dimensions.

8.1.3 Determination of Extraction Fluid

Transfer 5.0 g of the solid to a 500 ml. beaker. If particle size reduction is required it must be accomplished before performing this test.

Slurry the solid in 96.5 ml. of reagent water, cover with a watchglass and stir vigorously for five minutes using a magnetic stirrer.

Measure and record the pH of the slurry. If the pH is less than 5.0 Extraction Fluid#1 is to be used for preparation of the TCLP extract. Proceed to Section 8.2, below.

Add 3.5 ml. of 1N hydrochloric acid to the slurry. Mix thoroughly, cover with a watchglass and heat to 50o C for ten minutes without stirring.

Cool to room temperature and record the pH. If the pH is less than 5.0 use Extraction Fluid#1 for preparation of the TCLP extract. If the pH is equal to or grater than 5.0 use Extraction Fluid#2 for preparation of the TCLP extract.

8.2 Preparation of the TCLP Extract

8.2.1 Solid Wastes

If the waste is solid without a liquid phase weigh out 100.0 g and add to a bottle extractor.

Add 2.0 L of extraction fluid to the bottle extractor and close the seal.

Secure the extractor bottle in the agitation device and rotate for 16 to 20 hours in an area where the ambient temperature is maintained between 19 and 25o C.

Proceed to Section 8.2.3.

8.2.2 Liquid/Solid Wastes

Using the appropriate value of percent solids calculated in 8.1.1, above, estimate the amount of sample required to produce sufficient TCLP extract to support the analyses required. Weigh that amount into a beaker of appropriate volume.

Using an acid washed glass fiber filter, separate the liquid and solid phases of the waste using the filtration device as described in Section 8.1.1, above. Collect the filtrate in a clean vessel with a screw cap closure. The liner of the screw cap must be inert to the filtrate. The maximum pressure required to achieve separation may be applied to achieve the separation. The pressure should be applied gradually, however, since glass fiber filters are subject to rupture if subjected to abrupt pressure gradients.

If necessary reduce the particle size of the solids retained on the filter.

Quantitatively transfer the solids to an extractor bottle.

Calculate the amount of extraction fluid required as follows:

g fluid = (20 x percent solids x sample weight filtered)/100

Add the calculated amount of extraction fluid to the bottle extractor and close the extractor bottle.

Secure the extractor bottle in the agitation device and rotate for 16 to 20 hours in an area where the ambient temperature is maintained between 19 and 25o C.

8.2.3 Extract Filtration

Following extraction, filter the extraction fluid using an acid washed glass fiber filter and the filtration device. Collect the filtrate in a clean beaker of appropriate volume and record the pH. The solids may be discarded. If the original waste was a solid, proceed to Section 8.2.4, below.

If the initial liquid phase of the waste is compatible with the extract liquid combine the two liquids to form the TCLP extract. Proceed to Section 8.2.4, below

If the initial liquid phase of the waste and the extract liquid are incompatible do not combine them. Proceed to Section 8.2.4, below.

8.2.4 Extract Preservation and Storage

Reduce the pH of the extract to less than 2.0 using nitric acid. Store the preserved extract at 4o C until it is prepared for analysis as described in Section 9.0, below. If the initial liquid phase of the waste and the extract liquid were incompatible, preserve the extract liquid with nitric acid as noted above and store them separately until they are prepared for analysis as described in Section 9.0, below.

9.0 Sample Analysis (Metals)

TCLP extracts will be prepared for analysis using the procedures defined in the USEPA CLP Statement of Work for Inorganics Analysis, IFB No. D000461R2 or the most current revision. The analytical methods will be those described in the same document. Table 2 lists the methods by number and indicates those which will be employed in the event of catastrophic failure of ICP instrumentation.

TABLE 2
INORGANIC METHODS
ANALYTICAL PROCEDURES

I. Inductively Coupled Argon Plasma Technique
Method 200.7 CLP-M (1)
Elements

Aluminum	Chromiun	Selenium
Antimony	Cobalt	Silver
Arsenic	Copper	Thallium
Barium	Iron	Vanadium
Beryllium	Lead	Zinc
Boron	Magnesium	
Cadmium	Manganese	
Calcium	Nickel	

II Cold Vapor Atomic Absorption
Mercury - 245.2 CLP-M

III. Atomic Absorption Methods - Flame Technique (1)
Analyte/Method

Calcium-215.1 CLP-M	Potassium-258.1 CLP-M
Magnesium-242.1 CLP-M	Sodium-273.1 CLP-M

IV. Alternate Methods (Catastrophic ICP Failure
Analyte/Method - Furnace Technique (1)

Aluminum-202.2 CLP-M	Manganese-243.2 CLP-M
Barium-208.2 CLP-M	Nickel-249.2 CLP-M
Cobalt-219.2 CLP-M	Vanadium-286.2 CLP-M
Copper-220.2 CLP-M	Zinc-289.2 CLP-M
Antimony-204.2 CLP-M	Chromium-218.2 CLP-M
Beryllium-210.2 CLP-M	Lead-239.2 CLP-M
Cadmium-213.2 CLP-M	Silver-272.2 CLP-M
Arsenic-206.2 CLP-M	Thallium-279.2 CLP-M
Iron-236.2 CLP-M	

1. USEPA CLP Statement of Work for Inorganics Analysis, IFB No. D000461R2 or the most current revision.

TABLE 2 (Continued)
INORGANIC METHODS
ANALYTICAL PROCEDURES

V. Alternate Methods (Catastrophic ICP Failure) (Continued)
Analyte/Method - Flame Technique(1)

Aluminum-202.1 CLP-M	Iron-236.1 CLP-M
Antimony-204.1 CLP-M	Lead-239.1 CLP-M
Barium-208.1 CLP-M	Manganese-243.1 CLP-M
Beryllium-210.1 CLP-M	Nickel-249.1 CLP-M
Cadmium-213.1 CLP-M	Silver-272.1 CLP-M
Chromium-218.1 CLP-M	Thallium-279.1 CLP-M
Cobalt-219.1 CLP-M	Vanadium-286.1 CLP-M
Copper-220.1 CLP-M	Zinc-289.1 CLP-M

References

1. USEPA CLP Statement of Work for Inorganics Analysis, IFB No. D000461R2 or the most current revision.

10.0 Reporting

All results will be reported in CLP format on appropriate forms. The data will also include copies of laboratory notebook entries relative to preliminary evaluation of wastes to determine

total solids, particle size evaluation and (if required) reduction and determination of the extraction fluid required.

If the initial liquid phase of a waste and the extract from the solids are incompatible the two liquids will be analyzed separately and the results obtained on each fraction reported individually. A final analyte concentration in the waste will be calculated as a volume weighted average as follows:

Average = (P1 + P2)/(V1+V2) where:

V1 = volume in liters of first phase
V2 = volume in liters of second phase
P1 = V1 x conc'n of contaminant in first phase in mg/L
P2 = V2 x conc'n of contaminant in second phase in mg/L

Copies of notebook entries relative to the calculations above will be included with the data submitted and the final analyte concentrations will be reported on an appropriate CLP form.

10.0 Quality Control

The QA/QC procedures specified in the referenced CLP SOW will be followed. Data will be reported in appropriate CLP format.

PREVENTATIVE MAINTENANCE, PROCEDURES AND SCHEDULES

1.0 Hazardous Waste Filtration Systems

1.1 Pressure Unit (142mm) (Catalog No. YT30 142HW, Millipore Corporation).

1. When not in use

   a. Pressure released
   b. Tension released from handwheel knobs
   c. Cleaned and stored fully assembled.

2. When in use

   A. Daily

      a. Clean by trace metal Glassware procedure section 10.2 Pg of S.O.P. between each use

   B. Weekly

      a. Inspect teflon coating to insure that it is intact to guard against heavy metal contamination.

   C. Monthly

      a. Disassemble filtration system completely for complete cleaning.
      b. Inspect O-rings for proper seal.

   D. Yearly

      a. Replace worn teflon coated parts.
      b. Replace teflon and silicon O-rings and gaskets.

1.2 Zero head space unit (90mm) (Catalog No. YT30 090 HW, Millipore Corporation).

1. When not in use

   a. Unit is cleaned and stored assembled.
   b. No pressure on unit.
   c. No pressure on "O" rings, hand wheel knobs loose.

2. When in use

   a. Clean all parts in hot alconox water, rinse in tap water, rinse with DI water.
   b. If extremely dirty clean with ME CL_2 and acetone then give them alconox bath. Followed by water rinse.

3. Inspection

A. Weekly

1. Inspect entire unit for corrosion or visual signs of deterioration.
2. Check for cracks in "O" rings.

B. Monthly

1. Disassemble and clean entire unit.
2. Assemble and pressurize unit. "Check Leaks".
3. Replace any worn parts.

C. Yearly

1. Replace O rings, cylinder rings.

PREVENTATIVE MAINTENANCE

Balances

1. When Not In Use
   a. Beam fully arrested.
   b. All weights removed.
   c. Compartment and pan cleaned.
   d. Compartment closed with nothing on pan.
2. When In Use
3. Daily
   a. Level the balance.
   b. Zero the balance.
4. Weekly
   a. Clean the balance case.
   b. Clean the balance weighing compartment and pan.
5. Monthly
   a. Perform calibration check of balances using Class S weights.
   b. Check expiration date on static elimination sources
6. Annually
   a. Cleaned, serviced and recalibrated by outside firm.
   b. Certificate of Calibration obtained.

pH Meters

1. Daily
   a. Check the battery.
   b. Calibrate the system (meter and electrode) against two standard buffer solutions.

c. Rinse electrode throughly between samples and after calibration.

d. When not in use store the electrode in pH 4 or 7 buffer or saturated KCl solution.

e. Be on the alert for erratic response.

f. Occasionally check the buffer through the day recording the reading in the notebook.

g. At the end of the day, store the electrode in a buffer solution and turn the meter off.

2. Quarterly

a. Perform maintenance per manufacturers instructions.

b. Calibrate and perform quality control checks as necessary.

c. Analyze an EPA Quality Control Sample.

Gas Chromatograph Mass Spectrometers

ARDL uses Hewlett-Packard GC/MS equipment. The systems consist of: 1) a Model 5890 gas chromatograph; 2) a Model 5970 mass selective detector; 3) RTE data systems on HP1000 minicomputers; and 4) either a Tekmar ALS 2016 autosampler with LSC 2000 purge and trap (volatiles) or a Hewlett Packard Model 7673 autosample (semivolatiles). All equipment is covered under service agreement with Hewlett-Packard.

1. Tekmar Autosample/Purge and Trap

a. System Clean-Up - Bake sampler contaminants from trap as needed. Replace hydrocarbon trap as needed. Always use Matheson Purity gases.

b. Leak Check - Cap off vent port on front of concentrator. Load a water sample. Start purge. The purge gas should stop bubbling through the sample within several minutes.

If this procedure indicates a leak, then the following fittings should be checked: the top and bottom of the trap; glassware mounts; sample needle fittings.

c. Trap Replacement - as indicated by: Increase in background; loss of brominated compounds while others remain constant; increase in back-pressure.

d. Documentation - All preventive and routine maintenance operations will be recorded in the instrument logbook.

2. Model 7673 Autosampler

   a. Replace gas chromatograph septum daily.

   b. Monitor syringe system for appearance of bubbles, needle warp or other damage.

   c. Documentation - All preventive and routine maintenance operations will be recorded in the instrument logbook.

3. Model 5890 Gas Chromatograph

   a. Verify flow rates daily.

   b. Verify volumes of gas daily.

   c. Monitor chromatograms for appearance of anomolous peaks, poor chromatography or other signs of degradation of column performance.

   d. Clean injector and/or silanize glass lines when peak tailing becomes excessive.

   e. All preventive and routine maintenance operations will be recorded in the instrument maintenance logbook.

4. RTE Data System

   a. Hewlett-Packard personnel perform preventive maintenance on the system three times per year.

   b. Preventative maintenance procedures are recorded on Hewlett Packard report forms. Copies of these are retained on file in the laboratory.

5. Mass Selective Detectors

   a. Monitor chromatograms for appearance of anomolous data indicating degradation of detector sensitivity or performance.

   b. Disassemble and clean source as required to maintain system performance.

   c. Clean source rods as required to maintain system performance.

   d. All preventive and routine maintenance operations will be recorded in the instrument maintenance logbook.

Gas Chromatographs

ARDL operates a number of gas chromatographs including Hewlett-Packard Model 5890 with both FID and ECD, Shimadzu Model 14A and 8a with ECD and Tracor Model 540 with Hall/PID in series or with FID and ECD. General maintenance requirements for all gas chromatographs consist of the following:

1. Verification that all flows are set to manufacturers' and/or method specifications prior to use.

2. Check ferrules for wear on column installation or change over. Replace as needed.

3. Replace septa every 100 injections or as needed.

4. Clean injector and/or silanize glass lines when peak tailing becomes excessive.

5. Check carrier and other gas volumes: replace at 200-500 psig cylinder pressure.

6. Maintain low flow of carrier gas through systems when not in use.

7. Step through trouble shooting procedure by front panel control operation prior to use.

8 Monitor chromatograms produced for presence of anomolous peaks, poor sensitivity, loss of resolution or other signs of column or detector degradation.

9. FID - Clean jet and/or collector plates when baseline becomes excessive.

10. ECD - Guard against introduction of oxygen into the system. Do not change columns unless required by protocol. If it becomes apparent that the electrolytic cell is not functioning properly, remove the detector unit and return to the vendor for servicing.

11. Hall - Clean the conductivity cell when baseline or noise become excessive. Replace the scrubber when selectivity or peak shape becomes poor or there is excessive noise. Check the condition of the conductivity solvent before beginning a run. Replace the solvent and ion exchange resin if required.

12. All preventive and routine maintenance operations will be recorded in the instrument maintenance logbook.

GC Columns

1. Capillary - Maintenance not required. Cut off ends when installing after ferrule is put on. Check end for good square cut. Evaluate with test mix when peak shape deteriorates.

2. Packed - Store with ends sealed/capped. Condition per manufacturer specifications before use. Repack/replace when packing shows gaps, discoloration, etc.

3 All preventive and routine maintenance operations will be recorded in the instrument maintenance logbook.

Atomic Absorption Spectrophotometers

1. General

   a. Instrument data system checks

      Deuterium background lamp emission - replace if required. Hollow cathode lamp emission - replace if required.

   b. Annual preventative maintenance of total system by manufacturer's representatives.

   c. All preventative maintenance and repairs performed are recorded in the logbook maintained for each instrument.

2. Graphite Furnace

   a. Inspect autosampler tubing daily and replace as required.

   b. Inspect optics daily. Clean and adjust as required.

   c. Inspect graphite tube before beginning daily operations. Replace as required.

   d. Monitor data obtained while running. Replace graphite tube as required.

   e. Inspect furnace electrodes at least weekly. Replace as required or aty least semiannually.

3. Flame

   a. Check flow rates of all gases daily. Adjust as required.

   b. Inspect optics daily. Clean as required.

   c. Inspect flame assembly an nebulizer daily. Clean as required. Disassemble at least semiannually and clean using ultrasound in accordance with manufacturer's directions.

d. On disassembly of flame unit replace all seals and o-rings.

4. Cold Vapor

a. Change sample tubing daily.

b. Inspect reagent tubing daily. Replace as required.

c. Check gas flows at least quarterly or more frequently as dictated by sample throughput.

Inductively Coupled Argon Plasma Spectrometers

1. Semiannual preventative maintenance performed by manufacturer's representative.

2. All preventative maintenance and repairs performed are recorded in the logbook maintained for each instrument.

3. Daily

a. Inspect sample introduction pathway daily. Inspection to include nebulizer, spray chamber and torch. Clean or replace as indicated.
b. Inspect pump tubing. Replace as required.
c. (Leeman only). Clean torchbox

4. Weekly

a. Disassemble spray chamber, injector tube and torch and clean with ultrasound at least twice weekly. Replace parts as required.

b. Inspect inlet water filter. Replace element as required.

c. Inspect cooling air inlet filters. Replace or clean as required.

4. Monthly

a. Lubricate pump rollers.

b. Inspect source mirror. Clean as required.

c. Inspect remaining optical pathway. Clean as required.

Exhaust Hoods

Face velocity (sash fully open) of all hoods at ARDL is a minimum of 75 ft/min. (linear). This value is measured each month by a Dwyer vaneometer and the value . Should a hood face velocity fall below the minimum, corrective action is taken immediately. To insure proper operation of exhaust hoods follow the routine noted below.

1. Monthly

   a. Measure face velocity at several positions across the face of the hood and record the average value.

2. As Needed

   a. Clean hood and repair when broken or face velocity drops below 75 ft/min.

Ultrasonic Cell Disruptor

The sonicator contains inter-related mechanical, electronic, electromechanical and electromagnetic components. The mechanical items i.e., horns and tips, require regular preventive maintenance as follows:

1. Clean all threads and mating faces with alcohol prior to making connections.

2. Do not force threaded joints when making connections.

3. Smooth radiating face of tips with emery paper or crocus cloth once the tip gets a grey, matte finish.

4. Rinse the tip thoroughly with solvent after each extraction procedure.

5. Replace tip if it becomes pitted.

6 All preventive and routine maintenance operations will be recorded in the instrument maintenance logbook.

Inventory and Procurement

ARDL maintains an equipment parts inventory which includes those items which are required to maintain daily operation and which are unpredictable in failure. An inventory of expendable items such as chemicals, reagents, solvents, spare parts and gases is maintained on a regular basis to assure proper supplies are in-house at all times. The inventory is prepared by an analyst for the GC/MS Specialist's review. Requisitions for items needed are prepared and submitted to the General Laboratory Manager for review and are then forwarded to the Laboratory Director for final authorization.

CORRECTIVE ACTION

ARDL realizes that even the best systems are subject to change. In order to maintain data quality at an acceptable level, it is necessary that the quality assurance system be sensitive in detection of "out-of-control" or unsatisfactory conditions and that the detection is achieved in a timely fashion. It is equally important that, once unacceptable data is identified, a systematic response occurs to assure the immediate return to acceptable quality data. The primary goal of ARDL's corrective action process is to assure that the condition, whatever it may be, is reported to those who can correct it and appropriate corrective action can be taken.

When acceptance criteria are out of control further sample analyses are stopped and an effort made by the analyst and his immediate supervisor to determine the difficulty. Based on their judgment, the necessary corrective actions are taken until the problem is identified. The unacceptable QC data are repeated and all samples analyzed since the last previous acceptable QC data point are reanalyzed.

Major problems i.e., those which are not solved as above, are reported to the General Laboratory Manager and Laboratory Director by the Technical Services Manager. These individuals initiate a systematic investigation to resolve the out-of-control condition. In general, such investigations will involve:

1. Full description and definition of the problem;

2. Assignment of responsibility for conducting the investigation;

3. Detailed review of the progress of the investigation on a daily basis; and

4. In the event that the problem is catastrophic, these individuals will also take steps to arrange for alternate instrumentation to insure timely analysis of the samples being held.

INTERLABORATORY QUALITY CONTROL

In addition to the array of duplicates, spikes and laboratory control samples associated with specific analytical methods, ARDL has an active program for evaluation of data quality generated in the laboratory. That program consists of four major elements: 1) participation in the WS and WP PES programs administered by the USEPA; 2) maintenance of analytical certifications by the US Army Corps of Engineers, Illinois EPA and the Oklahoma Water Resources Board; 3) routine analyses of blind QC samples containing various analytes; and 4) internal audits of laboratory procedures and records conducted by ARDL's Quality Assurance Manager.

WS/WP PES Programs

ARDL has participated in the WS Study of the USEPA for several years and has recently enrolled as a participant in the WP Study. Overall performance in the WS Study has been acceptable (correct results on 90% or more of the determinations). It is anticipated that performance in the WP study will be similar.

The results of each study are reviewed with the analysts involved in developing the data. Incorrect results are emphasized during the review and laboratory records are examined to determine why a particular value was selected. These reviews are sometimes helpful in identifying problems in approach and/or procedure which effected analytical values. As appropriate, modifications consistent with approved methodology are incorporated into laboratory procedures to guard against reoccurences of these difficulties.

Certifications

Certification by the Illinois EPA is renewed annually. Certification by the Oklahoma Water Resources Board is renewed semiannually. PES samples from the Illinois EPA include metals, cyanide, nitrate, fluoride, pesticides, regulated volatile organics, trihalomethanes and acid herbicides as analytes. PES samples from the Oklahoma Water Resources Board include metals and nutrients as analytes. Performance on these samples has been good (95% or better correct results for Illinois and 100% for Oklahoma). A second analysis of analytes determined incorrectly is permitted by Illinois. In every case the second analysis has been correct.

Certification by the US Army Corps of Engineers is renewed approximately every 18 months. PES samples for this certification include all CLP target analytes in metals, volatile organics, base-neutral/acid semivolatile organics, pesticides, PCB's, polynuclear aromatics and acid herbicides. Performance on these samples has been good (more than 95% correct results).

As described above, results from these analyses are reviewed with the analysts involved to determine the reasons for incorrect values obtained.

Blind QC Samples

A new procedure for submitting blind QC samples to analysts has recently been adopted as a replacement for the previous system which had become unwieldy because of sample volume. Samples of known composition are prepared by members of the technical staff not engaged in analytical benchwork under the supervision of the Quality Assurance Administrator. These samples are then logged in as samples from regular customers who normally submit samples requiring determination of the analytes involved. The samples are handled normally in all respects, except that when results are obtained the Quality Assurance Administrator is advised and the reported values are compared to the "true values". If the values are incorrect, the Quality Assurance Administrator immediately advises the analyst and the analyst's supervisor so that corrective action can be taken.

Internal Audits

The Quality Assurance Administrator performs a complete audit of operations in a specific analytical or sample preparative laboratory. These audits are performed on an approximate semiannual basis. Analysts are observed during performance of their daily work and questioned relative to the procedures and methods they are employing. Logbook entries and other records are reviewed for completeness, legibility and accuracy. The results of the audit are reviewed with the analysts and their supervisors and a written report is prepared for review by appropriate members of the senior management staff.

SAMPLE CUSTODY

CUSTODY DEFINITION

All samples at ARDL are considered in custody since: 1) they are held within the perimeter of the laboratory after receipt; 2) the entire ARDL facility is protected by a perimeter alarm system; 3) specific sample storage areas are under controlled lock and key; 4) access to samples is restricted to individuals authorized to work with them; 5) access to the laboratory is restricted to employees or escorted visitors; 6) custody records are maintained by the sample custodian; and 7) after samples are removed from storage analysts are responsible for the custody of the sample and return to storage area at the end of the working day.

TRANSFER OF CUSTODY IN SHIPMENT

ARDL expects that CLP samples will be collected by USEPA personnel or their designated representatives. Samples arriving at ARDL from the field must be accompanied by a properly completed USEPA Chain-of-Custody Form (Figure 4). The ARDL sample custodian (or a designated alternate) is authorized to accept samples as follows:

1. Upon receipt of the samples, the sample custodian inspects the shipping container and documents the following information on Form QA-15.

    a. Presence or absence of EPA chain-of-custody forms.

    b. Presence or absence of airbills.

    c. Presence or absence of EPA Traffic Reports or SAS packing lists.

    d. Presence or absence of custody seals on shipping and/or sample containers and their condition.

    e. Presence or absence of sample tags.

    f. Sample tag ID numbers if not recorded on the chain-of-custody record(s) or packing list(s).

    g. Condition of the shipping container.

    h. Condition of the sample bottles.

    i. Verification of agreement or nonagreement of information on receiving documents.

    j. Resolution of problems or discrepancies with the Sample Management Office.

SAMPLE RECEIPT VERIFICATION REPORT

Sample ID _____

Date _____

	Present Yes/No	Comments
Chain of Custody	_____	_____
Airbills	_____	_____
Traffic Reports	_____	_____
SAS Packing List	_____	_____
Sample Tag	_____	_____
Sample Tag ID Number	_____	_____

Shipping Container - Condition Good ___ Fair ___ Unacceptable ___

Sample Bottle - Condition Good ___ Fair ___ Unacceptable ___

Verification of _____ agreement or _____ non-agreement of information on receiving documents.

Resolution of problems or discrepancies with SMO ___ yes ___ no

Comments: _____

_____

_____

_____

Sample Custodian: _____

Date: _____

Form QA-15

2. The sample custodian signs and dates all appropriate receiving documents at the time of receipt.

3. ARDL will contact the SMO if documents are absent, information on receiving documents do not agree, custody seals are not intact or the sample is not in good condition and any resolution of any discrepancies will be documented.

4. The sample custodian will label each sample or sample preparation container with the SMO number and record the number in the sample log book.

5. All information received with the sample is turned over to the document control clerk to initiate the case file. The samples are transferred to the GC/MS Specialist as discussed below.

LABORATORY CUSTODY PROCEDURES

STORAGE AREAS

The sample custodian transfers the samples to the internal custody of the GC/MS Specialist who immediately assigns a storage location (refrigerator) to each sample container(s). Sample holding areas at ARDL consist of: 1) locked, walk-in refrigerated space, or 2) an area in which only ARDL employees (or escorted visitors) are allowed. Keys to the refrigerated space are held by the Analytical Supervisor and the GC/MS Specialist. As directed by these individuals, analysts enter the sample storage area to obtain materials for analysis. The quantities used for each analysis are traceable through dated entries made in analyst laboratory notebooks. The samples are held until released by the Analytical Supervisor or GC/MS Specialist for disposal or the USEPA requests their return.

SECURITY

During working hours entry to ARDL's facilities is controlled through both front and rear entrances. The rear entrance is for commercial deliveries. It is kept locked and is monitored by the Shipping/Receiving Clerk. The front entrance is monitored by the receptionist. Access to the facility is made through a door fitted with an electric or simplex combination locks. All visitors are escorted while in any part of ARDL buildings.

At the end of each work day a "security check" is performed by the duty officer (DO). The DO tours the entire facility, both inside and outside, to ensure that 1) all outside storage buildings and entrances are locked; 2) all outside flood lights are working; 3) all inside safes and locked areas are secure and 4) all equipment and lights in respective labs have been turned off. This information is documented, dated and signed daily on a DO

checklist. After hours, the entire ARDL facility is protected by an electronic alarm system. The system consists of perimeter sensors mounted on all windows and outside doors and internal motion and infrared detector sensors. The doors to the refrigerated sample storage area are connected to the alarm system. The system is equipped with battery backup in case of power failure. Unauthorized entry to facility causes an alarm to sound at local police headquarters. Experience with inadvertent and false tripping of the alarm system has shown that police response is extremely rapid (5 to 10 minutes).

APPENDIX E

ATEC STANDARD OPERATING PROCEDURES

ATEC ASSOCIATES, INC.
STANDARD OPERATING PROCEDURE
PARTICLE SIZE ANALYSIS

1. **Parameter:** Soil Particle - size distribution

2. **Range of Measurement:** 0.0 - 100%

3. **Limit of Detection:** 0.0%

4. **Sample Matrix:** Soil

5. **Principle, Scope and Application:**

   Determine the particle size distribution in order to help classify the soil type and identify its properties.

6. **Interferences and Corrective Actions:**

   Equipment failure or technician error readjust, repair, or replace defective equipment and/or discuss error with the technician. Conduct duplicate test as necessary.

7. **Safety Precautions:**

   Wear safety glasses or gloves as needed for the contaminant present. Use alternate preparation methods if necessary.

8. **Sample Size, Collection, Preservation and Handling:**

   Sample size is dependent upon the largest diameter sediment grain in the soil to be analyzed. Each sample should be delivered/shipped in a sealed container (bag, jar, etc.) that is of sufficient size to contain the sample and will not permit the loss of any portion of the sample.

9. **Apparatus:**

- Balance sensitive to 0.01g,
- Mortor and rubber- tipped pestle,
- Stirring device "A" (per ASTM D-422; para. 3.2.1),
- Sedimentation cylinder (1000 ml),
- Soil Hydrometer 152-H (per ASTM D-422, para 3.3), and
- Sieves (per ASTM D-422; para. 3.6)

10. **Routine Preventative Maintenance:**

Balances are checked and serviced by a qualified service technician annually, and spot checked as needed. Sieves are checked with glass calibration spheres annually.

11. **Reagents & Calibration Standards:** None

12. **Calibration Procedures:** None

13. **Sample Preparation:**

Samples are air dried at room temperature then broken down to particle size using a mortor and rubber-tipped pestle.

14. **Analytical Measurement:** Not Applicable

15. **Flow Chart:** See Attached Exhibit

16. **Data Treatment:**

% Soil in Suspension	Diameter of Soil Particles
P = (Ra/W) X100	D = K x SQRT (L/T)
R = Hydrometer reading	K = Constant (Table 3; ASTM D-422)
A = Correction factor (Table 1, ASTM D-422)	
W = Oven dry soil weight	L = Effective depth (Table 2; ASTM D-422)
	T = Elapse time of reading
	SQRT = Square root

17. **Data Deliverables:**

a. Case narrative

b. Summary of all tests, and QC duplicate results (if required).

c. Copies of lab data sheets (if required)

d. Copies of any other pertinent sample documentation.

18. **Quality Control Requirement:**

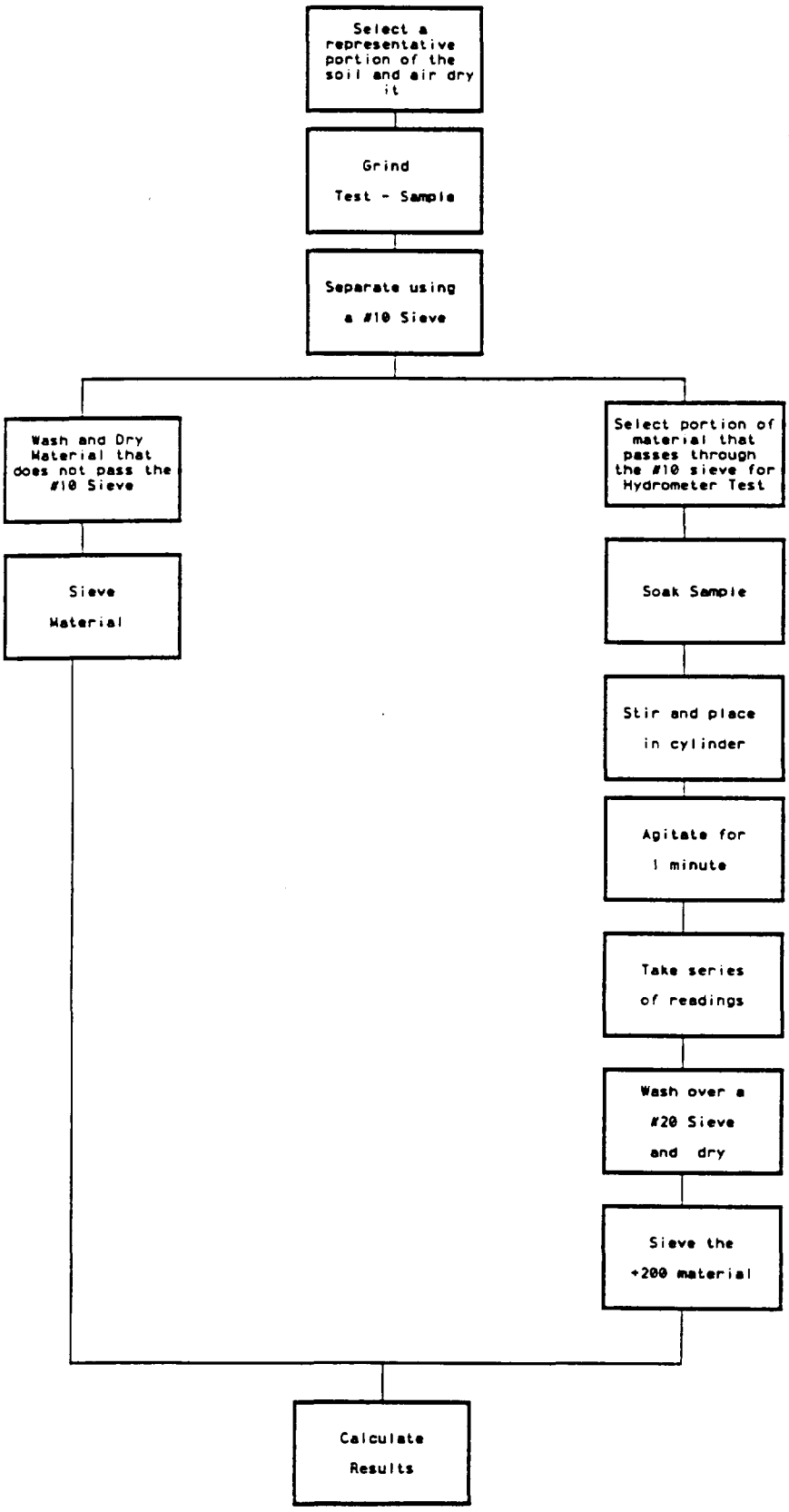
Duplicate test as requested.

19. **References:**

ASTM D-422-63

20. **Method Validation Data:** Not-Applicable

Particle Size Analysis Flow Chart



ATEC ASSOCIATES, INC.
STANDARD OPERATING PROCEDURE
TOTAL POROSITY

1. **Parameter:** Porosity

2. **Range of Measurement:** 0.00 - 100%

3. **Limit of Detection:** 0.00%

4. **Sample Matrix:** Soil

5. **Principle, Scope and Application:**

   Determine the porosity of the soil sample to identify its engineering properties.

6. **Interferences and Corrective Actions:**

   Equipment failure or technician error. Readjust, repair or replace defective equipment and/or discuss error with the technician. Conduct duplicate test as necessary.

7. **Safety Precautions:**

   Water safety glasses or gloves as needed for the contaminant present. Use alternate preparation methods if necessary.

8. **Sample Size, Collection, Preservation and Handling:**

   Sample should be a tube or block sample. It is to be maintained in an undisturbed condition and sealed to prevent moisture loss. These samples should be hand delivered or well protected during shipment.

9. **Apparatus:**

Sample extrude or trimming device, calipers, balance sensitive to 0.01g, drying oven, vacuum pump, and a volumetric flask.

10. **Routine Preventative Maintenance:**

Balances are checked and serviced by a qualified service technician annually, and spot checked as needed.

11. **Reagents & Calibration Standards:** None

12. **Calibration Procedures:** None

13. **Sample Preparation:**

Samples are extruded and/or trimmed to a "regular" shape (usually a cylinder) and a portion of the trimmings are used for the specific gravity determination.

14. **Analytical Measurement:** Not Applicable

15. **Flow Chart:** See Attached Exhibit

16. **Data Treatment:**

Total Porosity (n)

$$n = \frac{V - (Ws/Gs)}{V} \times 100$$

V = Volume of the wet soil
Ws = Dry weight of the soil
Gs = Specific gravity of the soil

17. **Data Deliverables:**

a. Case narrative

b. Summary of all test and QC duplicate results (if required)

c. Copies of lab data sheets (if required)

d. Copies of any other pertinent sample documentation.

18. **Quality Control Requirements:**

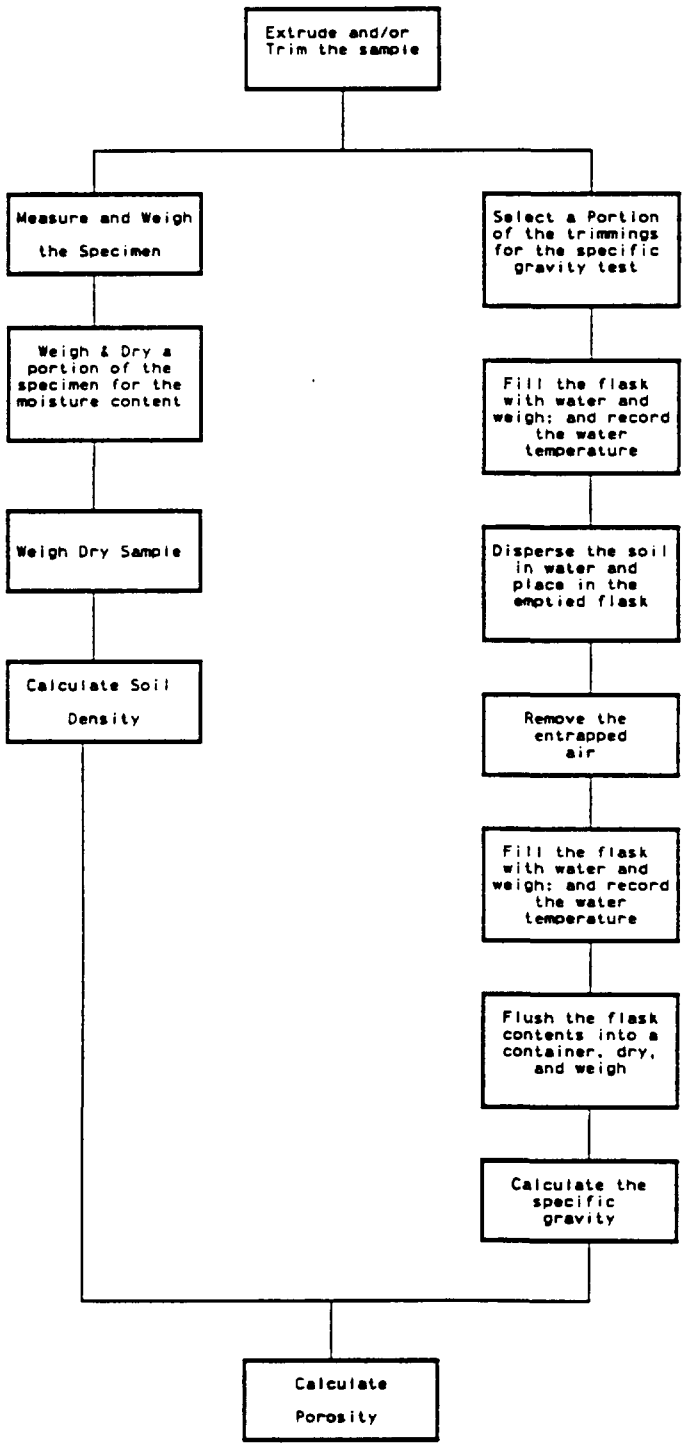
Duplicate tests are requested.

19. **References:**

ASTM D-854-83
US Army Corps of Engineers manual EM 1110-2-1906
30 Nov. 70; Appendix II

20. **Method Validation Data:** Not-Applicable

Total Porosity Analysis Flow Chart



ATEC ASSOCIATES, INC.
STANDARD OPERATING PROCEDURE FOR
TOTAL ORGANIC CARBON USING
DOHRMANN DC-80 TOTAL ORGANIC CARBON ANALYZER

Principles of Operation:

The TOC (Total Organic Carbon) analyzer is a relatively inexpensive test used for screening purposes. It can not identify specific organic compounds, but it can indicate and quantify their presence within the range of 10-800 ppm for waters and 100-4000 ppm for soils. The method described herein determines the total organic carbon by the use of high temperature combustion and infra-red detection of CO_2.

TOTAL CARBON = INORGANIC CARBON + ORGANIC CARBON (TOC)

Non-purgeable Organic Carbon (NPOC) + Purgeable Organic Carbon (POC)

For water samples, the TOC is determined by difference. First, the total carbon is determined by combusting the water sample at 800C into CO_2 and H_2O. Then, the inorganic carbon is determined by acidifying and purging the sample in the sparger vessel. This converts the inorganic carbon, specifically the carbonates and bicarbonates, into CO_2 which is measured by the detector. The organic carbon compounds are not converted to CO_2 within the sparger; therefore, they are not read by the detector.

Specifically the POC leaves the sparger as it is, and the NPOC remains in the sparger vessel. Finally, to obtain the TOC, the inorganic carbon value is subtracted from the total carbon value.

For soil samples, the inorganic carbon is first removed from the sample by acidification and drying. Then, the organic carbon content is measured by combustion. The volatile organic in the soil samples, however, may be lost during the removal of inorganics, thus resulting in a low bias. This can be minimized by keeping the sample at 4°F and analyzing within the specified holding time of fourteen days.

Start Up Procedure:

1. At least an hour before planned analysis, turn on furnace module by depressing white "FURNACE" button. (Furnace may be turned on the night before and left on if instrument will be used continuously for several days.)

2. Before starting analysis, open the O_2 gas cylinder valve on the tank and make sure the outlet pressure is set at approx. 40 psi. This should give you a flow rate of 200cc/min into the race. (The cylinder should be changed when the tank pressure approaches 500lbs.)

3. Lift top cover on furnace module to expose two glass chambers. The one towards the front, the sparger, will have to be

reconnected at the top to close the system. This is done by refitting the teflon tubing and septa into the top of the sparger. When the gas is not on, this tubing must be removed from the sparger, or it will pull water back into the pyrolysis tube.

4. When the furnace has reached equilibrium, the end nearest the detector module cabinet will glow red.

5. The electronics can then be turned on by depressing the white "POWER" button on the lower left face of the control module.

6. The red "ERROR" light will come on, and the display will consist of four horizontal bars.

7. To obtain a digital readout, the "START" button must be pressed and released five times in rapid succession.

8. The "ERROR" light should go out, and the "READY" light should come on. The horizontal bars should be replaced by zeros, and the operator should hear a "beep-beep-beep" signal.

9. To check the detector baseline, flip the toggle switch into the "DET" position.

10. The digital readout should be in the range 0.010 to 0.020.

When the readout has stabilized ± 0.002 digits, the system is ready to run. Record this number under "DETECTOR" in the log book. (If the baseline exceeds 0.020, the zero control knob needs to be adjusted. This is an indication that the sample cell is getting dirty.)

Calibration Procedure:

1. Select appropriate operating range: 40ul(2000ppm) setting for soils and 200ul(400ppm) setting for waters.

2. If "CALIBRATE" light is on, lift the clear plastic cover and depress button until the light goes out. This will clear the previous calibration factor in memory. The calibration remains even if the power is turned off. The only way to un-calibrate is to press the "CALIBRATE" button for more than one second.

3. Set toggle switch to "ppm C" position.

4. Before running any samples or standards, use the red magnet on the furnace extension to draw the boat just in front of the metal chamber for cooling. (Make sure the boat had ample time in the furnace to burn off any contamination before calibrating.)

5. After 1-2 minutes, draw the boat into the race until it is

aligned with the injector port.

6. Draw a 40ul aliquot of KHP std. into the syringe. For soils use 2000ppm KHP and for waters use 400ppm KHP. (Wipe needle dry with Chem-wipe to improve precision.)

7. Remove thermo-green septum in injector port, and inject the 40ul aliquot of KHP into the quartz wool in the boat. Quickly place the septum back into the injector port and start the cycle by pressing the "START" button. Then steadily slide the boat into the furnace. (During the injection, be careful not to pull any of the quartz wool out of the boat.)

8. Record the value displayed at the end of the cycle in the log book under "CALIBRATION". For the 400ppm standard in the 200ul setting, this value should be 60 $\pm$ 15 uncalibrated units and 1500 $\pm$ 375 for the 2000ppm standard in the 40ul setting. (If the values do not fall within this range, re-make the standard.)

9. Repeat the injection of standard at least three times (or until the values are within $\pm$ 2% of their mean.)

10. Obtain the calibration factor by depressing the yellow "CALIBRATE" button until it lights. This value should be 400 $\pm$ 10 for waters and 2000 $\pm$ 50 for soils. Repeat the above

calibration procedures if calibration factor is not within the ranges stated.

11. The instrument must be calibrated every day before any samples are analyzed.

Safety Precautions:

1. Use safety goggles and lab coat while in lab.
2. Use proper protection when using concentrated acid.

Analysis of Samples:

A. WATERS

1. Before running any samples, run the 10ppm KHP standard and the 400ppm KHP standard to verify the calibration. Then run a blank. (This may be DI or a reading of the empty boat.)

2. If you transfer the samples into plastic vials, make sure you do not leave any headspace in the vials, or you will lose the volatile compounds.

3. All water samples should be run in pairs. If the readings vary by more than 2% of the mean, a second pair is analyzed.

4. Inject a 40ul aliquot of sample into the boat and record

the value displayed at the end of the cycle under "TOTAL CARBON". (This is the total organic and inorganic carbon.)

5. When the cycle is finished, draw the boat just in front of the metal chamber to cool.

6. After cooling for 1-2 minutes, repeat step 4 to obtain the second value for "TOTAL CARBON". (When the 2nd run is finished, leave the boat in the furnace.*)

7. Inject a 40ul aliquot of sample into sparger by piercing the grey septa with the syringe and immediately press the "START" button. Record the value displayed at the end of the cycle under "INORGANIC CARBON". Repeat.

8. To obtain total organic carbon (TOC), the inorganic carbon value is subtracted from the total carbon value.

* Note: As the boat cools, it will accumulate carbonaceous impurities from the carrier gas. Thus, leaving the boat in the furnace during the inorganic analysis allows you to maintain a more constant cooling time for subsequent total carbon values.

B. SOILS:

1. Before running any samples, run a 100ppm KHP standard and

a 2000ppm KHP standard to verify the calibration. Then run a method blank. (This is an empty boat taken through all of the following steps.)

2. Using the red magnet, pull the boat into the cooling chamber. Lift the flip-top hatch by depressing the red handle.

3. With a pair of tweezers, remove the boat from the platinum wire push rod and immediately close the hatch. (Be careful not to touch the boat.)

4. Remove the quartz wool with tweezers and then place boat on a watch glass.

5. Weigh watch glass and boat on an analytical balance. Tare. Add 2-10mg of a well mixed soil sample. (The weight may be adjusted according to the carbon content of soil.)

6. For best results, try to spread soil evenly in boat, then add 1-2 drops of 1:1 nitric acid to convert carbonates into CO_2.

7. Place in oven at 90C for 10 min. This step insures that all the inorganic carbon has been removed.

8. Lift flip-top hatch on the cooling chamber, and with tweezers, place boat back onto the platinum push rod. Close hatch.

9. Flip toggle switch to "DET" and wait for the baseline to stabilize.

10. Press "START" button and glide boat into furnace.

11. Record the value at the end of the cycle under "INSTRUMENT READING".

12. To determine the total organic carbon, this calculation is used:

$$TOC(ppm) = \frac{(INSTRUMENT\ READING(ppm) - METHOD\ BLANK(ppm)) \times 80ugC}{2000ppm \times WEIGHT\ OF\ SAMPLE(g)}$$

13. After the cycle is finished, remove the boat from the flip-top hatch, close the hatch, and remove any residue left on boat with a metal spatula.

14. Run each soil sample once.

15. For every ten samples, run two check standards, one at detection limit (100 ppm) and one at mid-level (2000 ppm).

16. For every twenty samples, run a quadruplicate. Report both the average and the standard deviation. If the S.D. of the quad exceeds 3 x S.D. of the Control chart, identify and correct error and re-run samples in that batch along with the quadruplicate sample. (The Control Chart consists of one sample run fifteen times to determine analytical precision. Run monthly).

17. For every twenty samples, run a matrix spike and matrix spike duplicate. Spike soil aliquot with 40 uL of 2000 ppm KHP. Report percent recovery and relative percent difference.

Use following calculations:

a. $\frac{800\ ug}{2000\ ppm} = \frac{X\ ug\ spiked}{conc.\ std\ Spiked\ (ppm)}$ | $\frac{X\ ug\ spiked}{Weight\ of\ Sample\ (g)}$ = Spike Added (ppm)

b. $\%\ Recovery = \frac{M.S.\ or\ MSD\ Conc.\ (ppm)}{Spike\ Added + Sample\ Conc.} \times 100\%$

c. $R.P.D. = \frac{|M.S. - M.S.D|}{M.S. + M.S.D/2} \times 100\%$

18. Determine percent moisture on a separate 1g sample aliquot. Dry and heat at 103-105°C for one hour. Cool in desicator send reweigh to nearest mg.

Maintenance:

A. Boat Cleaning

1. Remove boat from the flip-top hatch. Using tweezers, remove any fragments of quartz wool in the boat.

2. Moisten a fresh piece of quartz wool with DI. Then place quartz wool in the boat and gently press the quartz wool into place. (Try to keep the wool in one piece so that it will not tear as easily during injections.) If run continuously, the quartz wool will need to be changed 1-3 times a day.

3. Return boat to pyrolysis tube.

4. To clean the new quartz wool, slide the boat into the furnace and let it bake for a few minutes. (Do not press the "START" button)

5. Flip the switch to "DET" and wait for the baseline to return to normal. Then draw the boat out of the furnace to cool.

6. At the end of the day soak the boats in conc. nitric acid for ten minutes and then rinse thoroughly with DI water.

B. Refilling Sparger

1. At the end of each day, empty and refill the sparger with acidified DI water. (Acidify to pH$\leq$2 with conc.

phosphoric acid.) This is necessary to remove the NPOC which accumulates in the vessel.

2. Maintain the sparger volume just above the fill line. If the level falls during the day, simply add more acidified DI into the top of the sparger.

C. Septum Replacement

1. Pyrolysis tube: Due to excessive heat exposure, the grey septa on the left end of the pyrolysis tube will become brittle and crack. Replace as needed.

2. Sparger: The injection septum should be replaced every 100 injections or so or at any time leakage is obvious.

3. Tin/Copper Scrubber: When copper becomes dull in appearance, the tube should be repacked.

Standard Preparation:

1. Prepare a 2000 ppm C standard by weighing 425 mg of Potassium Hydrogen Phthalate ($C_8H_5O_4K$), i.e. KHP. Transfer quantitatively with DI water to a 100 mL flask. Dissolve, add 0.1 mL of concentrated nitric acid (HNO_3) and bring to volume with DI water. Store in amber glass jar in refrigerator. Replace monthly.

2. Prepare a 400 ppm C standard by introducing 20.0 mL of the 2000 ppm C standard into 100 mL volumetric flask. Bring to volume with DI water. Store in amber glass jar in refrigerator. Replace weekly.

REFERENCES:

-DOHRMANN DC-80 TOTAL ORGANIC CARBON SYSTEMS MANUAL

-LLOYD KAHN JULY 1988

-SW846 METHOD 9060

TOC

DATA DELIVERABLES: Lloyd Kahn Method

1. Case Narrative For Parameter
2. Report of Test Results For each sample
3. Lab blanks for matrix
4. Quadruplicate Analysis - For each batch or maximum of 20 samples - to determine standard deviation error
5. Control chart - Run 1 sample 15 times and calculate standard deviation for precision

U.S. EPA Region I
SAS 5[redacted]
ATEC Project No. 21-08[redacted]
September 7, 1990

Total Organic Carbon Analysis Narrative

Upon receipt from our materials division, the samples were dried and analyzed for Total Organic Carbon Content according to the Lloyd Kahn Method dated July 27, 1988.

Testing was performed on a Xertex Dohrman DC-80 Total Organic Carbon Analyzer. Instrument calibration of precision was performed by analyzing one sample with 15 replicates and calculating the standard deviation. Results are reported on a dry weight basis.

Sample 5[redacted]-006 exceeded the saturation range of the detector using 0.001g of sample. This result is reported as a greater than number since we are unable to weigh out less of this particular sample.

REPORT OF TEST RESULTS

ATEC Project Number 21-08[redacted]

Date: September 6, 1990

Client: U.S. EPA Region I

Sample Identification: SAS Project 5[redacted]
Total Organic Halide Analysis
Lloyd Kahn Method July 1988
Analytical Results

Sample Taken By:	EPA
Sample Matrix:	Soil/Water
Date Sampled:	August 7 and 8, 1990
Date Received:	August 15, 1990
Date Analyzed:	August 21, 1990
Analyst:	EYV
Verified By:	KSK
ATEC Lab Number:	9008174

U.S. EPA Number	ATEC Lab Number	TOC	Detection Limit
5[redacted]-001	9008174-1	14,000 ppm	100 ppm
5[redacted]-002	9008174-2	37,000 ppm	100 ppm
5[redacted]-003	9008174-3	43,000 ppm	100 ppm
5[redacted]-004	9008174-4	89,000 ppm	100 ppm
5[redacted]-005	9008174-5	100,000 ppm	100 ppm
5[redacted]-006	9008174-6	>280,000 ppm	100 ppm
5[redacted]-007	9008174-7	35 ppm	1.0 ppm

Respectfully submitted,
ATEC Associates, Inc.

Keith S. Kline

Environmental/Analytical Testing Division

REPORT OF TEST RESULTS

ATEC Project Number 21-08[redacted]

Date: September 6, 1990

Client: U.S. EPA Region I

Sample Identification: SAS Project 5[redacted]
Total Organic Halide Analysis
Lloyd Kahn Method July 1988
Method Blank Results

Sample Taken By: EPA
Sample Matrix: Soil/Water
Date Analyzed: August 21, 1990
Analyst: EYV
Verified By: KSK
ATEC Lab Number: 9008174

ATEC Lab Number	TOC	Detection Limit
Lab Blank 821 Soil	<100 ppm	100 ppm
Lab Blank 821 Water	<1.0 ppm	1.0 ppm

Respectfully submitted,
ATEC Associates, Inc.

Environmental/Analytical Testing Division

REPORT OF TEST RESULTS

ATEC Project Number 21-08[redacted]

Date: September 6, 1990

Client: U.S. EPA Region I

Sample Identification: SAS Project 5[redacted]
Total Organic Halide Analysis
Lloyd Kahn Method July 1988
Quadruplicate Analysis

Sample Taken By:	EPA
Sample Matrix:	Soil
Date Sampled:	August 7 and 8, 1990
Date Received:	August 15, 1990
Date Analyzed:	August 21, 1990
Analyst:	EYV
Verified By:	KSK
ATEC Lab Number:	9008174

Standard Deviation = 5188

U.S. EPA Number	ATEC Lab Number	TOC	Detection Limit
5[redacted]-003	9008174-3	46,000 ppm	100 ppm
5[redacted]-003	9008174-3	57,000 ppm	100 ppm
5[redacted]-003	9008174-3	56,000 ppm	100 ppm
5[redacted]-003	9008174-3	50,000 ppm	100 ppm

Respectfully submitted,
ATEC Associates, Inc.

Kevin S. Kline

Environmental/Analytical Testing Division

REPORT OF TEST RESULTS

ATEC Project Number 21-08[redacted]

Date: September 6, 1990

Client: U.S. EPA Region I

Sample Identification: SAS Project 5[redacted]
Total Organic Halide Analysis
Lloyd Kahn Method July 1988
Control Chart

Sample Matrix: Soil
Date Analyzed: August 20 and 21, 1990
Analyst: EYV
Verified By: KSK
ATEC Lab Number: 9008174

Standard Deviation = 1437

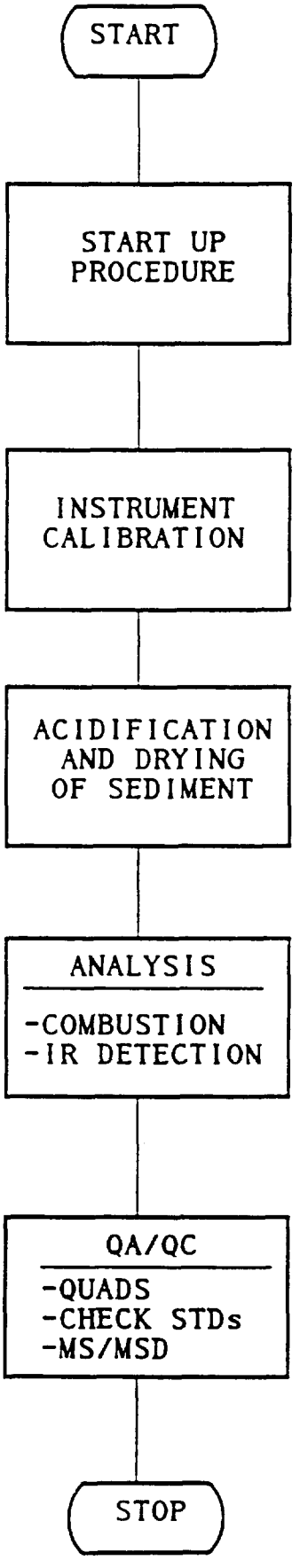
U.S. EPA Number	ATEC Lab Number	TOC	Detection Limit
5[redacted]-001	9008174-1	14,000 ppm	100 ppm
5[redacted]-001	9008174-1	15,000 ppm	100 ppm
5[redacted]-001	9008174-1	18,000 ppm	100 ppm
5[redacted]-001	9008174-1	15,000 ppm	100 ppm
5[redacted]-001	9008174-1	14,000 ppm	100 ppm
5[redacted]-001	9008174-1	16,000 ppm	100 ppm
5[redacted]-001	9008174-1	12,000 ppm	100 ppm
5[redacted]-001	9008174-1	14,000 ppm	100 ppm
5[redacted]-001	9008174-1	15,000 ppm	100 ppm
5[redacted]-001	9008174-1	14,000 ppm	100 ppm
5[redacted]-001	9008174-1	15,000 ppm	100 ppm
5[redacted]-001	9008174-1	16,000 ppm	100 ppm
5[redacted]-001	9008174-1	15,000 ppm	100 ppm
5[redacted]-001	9008174-1	16,000 ppm	100 ppm
5[redacted]-001	9008174-1	17,000 ppm	100 ppm

Respectfully submitted,
ATEC Associates, Inc.

Keith S. Klein

Environmental/Analytical Testing Division

TOC Analysis Flow Chart



ATEC Associates, Inc.

LAB WORK ORDER
CHEMISTRY LAB

JOB NUMBER _____ DATE ASSIGNED _____

JOB NAME _____ DATE REQUIRED _____

LOCATION _____

CLIENT (BILLING INFO) _____

_____

SAMPLE (CIRCLE) - POSSIBLE HAZARDOUS MATERIALS (SPECIAL HANDLING MAY BE REQUIRED) ☐ YES ☐ NO

SOIL COAL ASBESTOS (BULK OR AIR SAMPLE)

ROOFING WATER (WASTE OR WELL) SOLID WASTE

OTHER: _____

SAMPLE I.D.	TEST REQUIRED (eg pH, metals, TOX, BOD, Asbestos)	COMPUTER BILLING CODE

SAMPLE LOCATION: ☐ LIBRARY ☐ CHEM LAB ☐ MAIN LAB

SPECIAL INSTRUCTIONS: _____

_____

_____ ☐ OKAY TO INVOICE

_____

_____ ASSIGNED BY: _____

WHITE - ORIGINAL (WORKING COPY) YELLOW - FILE COPY PINK - ENGINEERING COPY

ATEC Associates, Inc.

LAB WORK ORDER
ENGR. & DRILLING DIV.

JOB NO. ______________________ DATE ASSIGNED ______________________

JOB NAME ______________________ DATE REQUIRED ______________________

CLIENT ______________________

COMPUTER → BILLING CODE																					
													PERM.		PROCTOR				OTHER		
BORING	SAMPLE	DEPTH	EXTRUDE	MC	DENSITY	WASHED SIEVE	HYDR.	-200	PI	CONSOL.	UNCONF.	UU*	CU*	FALLING HEAD	TRIAX.	STD	MOD	CBR	LOI		

(* GIVE NO. OF PTS.)

POSSIBLE HAZARDOUS MATERIALS ☐ YES ☐ NO

SPECIAL INSTRUCTIONS ______________________

____

____

____

______________________ ASSIGNED BY: ______________________

ATEC Associates, Inc.

LAB WORK ORDER
MATERIALS DIVISION

JOB NO. _____ DATE ASSIGNED _____

JOB NAME _____ DATE REQUIRED _____

LOCATION _____

CLIENT _____

POSSIBLE HAZARDOUS MATERIALS ☐ YES ☐ NO

SAMPLE (CIRCLE)

SOIL AGGREGATE ASHALT (CORE or BULK) CONCRETE CORES

BRICK FIREPROOFING ROOFING CEMENT

OTHER: _____

NO. OF SAMPLES: _____

	COMPUTER→ BILLING CODE													
SAMPLE LOG NO.	SAMPLE SOURCE AND DESCRIPTION	PROCTOR		SIEVE		EXTRACTION & GRADATION	DENSITY	MARSHALL STABILITY & FLOW	COMPRESSIVE STRENGTH	OTHER				
		STD	MOD	-200 ONLY	WASHED									

SAMPLE LOCATION: ☐ LIBRARY ☐ PROCTOR ROOM ☐ MAIN LAB ☐ CONCRETE LAB

SPECIAL INSTRUCTIONS: _____

ASSIGNED BY: _____

15. CORRECTIVE ACTION

15.1 General

Corrective action will be required whenever the measurement system generating the data is found to be out of control. The determination of whether a system is out of control will be made based upon the correlation between predetermined limits and the actual analytical values. The corrective action is intended to be initiated by the person closest to the actual problem or the first person to determine a problem exists. Ideally the analyst should initiate the action, however, group leaders also share the responsibility for determining if the analytical system is out of control. If any question exists on staff's behalf as to whether or not the system is out of control, laboratory management will be advised of the concern and asked for their final decision.

15.2 Acceptance Limits

The measurement system is to be considered to be out of control when any of the following occur:

a. Whenever the method blank result exceeds the detection limit required for the parameter in the accepted analytical method. EXCEPTION: Common solvents such as acetone, methylene chloride, etc. in the volatile organic analysis blank. These must be less than five times their detection limit.

b. Whenever the laboratory replicate exceeds the limits established in the accepted analytical method or 25 percent RPD, whichever is greater.

c. Whenever reference materials or laboratory fortified sample results fall outside the ranges specified in the accepted analytical method or the range of 75 - 125 percent recovery, whichever is greater.

d. Whenever the surrogate recoveries exceed the limits established by the accepted analytical method or the range of 75 - 125 percent recovery, whichever is greater.

e. Whenever the mid-range standard is less than 50 percent or greater than 200 percent of its absorbance, area or peak height found in the corresponding compound in the same or previous analytical run.

Due to the relatively large mathematically derived percents found when comparing small numbers, especially those at or near the analytical method detection limits, special consideration must be taken when determining acceptability of low level results. Whenever the analytical values under

consideration in item b. above, or in other similar samples, are found to be less than ten times the method detection limit, they are exempt from these guidelines. The results may be considered suspect if they exceed 100 percent RPD.

If the laboratory is able to demonstrate that the problem is beyond the control of the laboratory, the sample(s) need not be re-analyzed. If the problem is within the control of the laboratory, the sample(s) are to be re-analyzed after the system has been returned to in-control status. Screening of known or suspected highly contaminated samples to allow the appropriate addition of surrogates and internal standards is recommended. Inclusion of these results may justify outliers due to interference or dilution factors. The client or project manager responsible for the sample in question will be advised by laboratory management of the analytical concern in regards to the out of control situation.

15.3 Initiation of Action

Corrective action may be initiated as a result of the following activities:

a. daily quality control system failure
b. performance audit failure
c. system audit failure
d. laboratory comparison failure
e. other audit or study failure

Failures of the above activities will be as a result of an analytical value being outside of the acceptance limits for that particular activity. Failure in the daily quality control system will be considered to be a out of control situation requiring the system to be stopped until corrective action measures have been taken and further evaluation has determined that valid data can again be generated. Failure in the other areas above will not necessarily mean the complete stoppage of analysis for that area. A review of the results causing the failure and evaluation of the possible reasons for the failure will be performed. If major concerns surface during this review, analytical activities in the area of failure will cease until corrective actions are completed.

Corrective action may be initiated at the request of any client or auditing/certifying body for any justifiable or reasonable cause or if deemed necessary for quality assurance/quality control purposes.

15.4 Corrective Actions

Corrective action will be implemented whenever the analytical procedure is out of control. The problem must be found and corrected before further analysis is pursued. Corrective action may include, but not be limited to:

a. recalibration of instruments using freshly prepared standards.
b. replacement of solvent lots or other reagents responsible for unacceptable blank values.
c. additional training of laboratory personnel, if necessary, to improve the overlap between operator skills and method requirements.
d. reassignment of personnel.
e. re-extraction and/or re-analysis of sample per method requirements.
f. instrument check for possible maintenance needs.

Following the corrective action steps, QC samples must be analyzed and satisfactory results obtained before a system can return to analysis of samples. Once the system has returned to the in-control status, any samples analyzed while the procedure was out of control will be re-analyzed.

13. PREVENTIVE MAINTENANCE

13.1 General

A schedule of important preventive maintenance tasks is implemented by the analyst for each instrument. The purpose of the schedule is to minimize downtime of the various instruments. A new schedule is developed for each instrument brought into the laboratory. The schedule contains provision for such activities as cleaning of parts or whole instruments, alignment of optics or detectors, fluid flow adjustments, parts replacement, temperature checks, etc.. Many of these activities are performed daily, depending upon the instrument involved.

It is the analytical area group leader's responsibility to see that the requirements of the preventive maintenance schedule are developed, updated, and implemented on a regular basis. It is the individual analyst's responsibility to perform the preventive maintenance tasks. The first daily instrument check is to determine if the instrument is on or off. This check must also be performed prior to any preventive maintenance tasks for safety purposes.

The ATEC preventive maintenance schedule is shown in Table 13.1-A.

13.2 Contingency Plan

It is understood that from time to time circumstances may occur such that unscheduled instrument downtime may result. Samples scheduled for analysis on that instrument may need to be routed elsewhere for analysis during these periods of time. ATEC may be able to perform the analysis in-house on another instrument or may elect to send the samples elsewhere for the requisite analysis. If time is a critical factor, ATEC has corporate laboratories or other contract laboratories available to complete the analyses. Selection will be based upon the quality required for the project being delayed by the downtime. If time is not a critical factor, sample analysis will be completed on the original instrument at the first available time after that instrument is returned to operating standards.

M. PURGE AND TRAP SYSTEM

1. Check parameters, run standards, blank, samples, QC	1. Replace trap, clean purge vessel	1. NA

N. REFRIGERATOR/WALK-IN COOLER

1. NA	1. Temperature checked and logged daily	1. NA

O. DEIONIZED/ORGANIC FREE WATER SYSTEM

1. NA	1. Conductivity checked and logged daily 2. Ion exchange bed changed 3. Filters replaced	1. NA

P. VACUUM PUMP/AIR COMPRESSOR

1. NA	1. Check performance weekly 2. Lubricate 3. Check belts, gaskets, etc.	1. NA

Q. TOC ANALYZER

1. Check CU and SN scrubbers 2. Calibrate to selected range 3. Check O_2 flow at tank 4. Check DI and persulfate levels	1. Adjust and change pump tubes if needed	1. NA

ATEC ASSOCIATES, INC.

SOILS LABORATORY

LABORATORY SAMPLE CUSTODY

Upon receipt, the chain-of-custody (if possible) is signed by the lab supervisor, or technician, that receives the samples. The samples are then logged, and assigned a consecutive sample log number. A work order is prepared for the sample, or group of samples, and the test(s) that are to be conducted on each sample is indicated. If a sample requires both physical and chemical tests, a separate chemistry lab work order is prepared and a representative portion of the sample is obtained and taken to the chemistry lab. All work orders, sample tags, lab sheets, etc. must have the appropriate sample log numbers on them. The unused portions of the samples are maintained in the laboratory for 30 days after the test is completed unless other arrangements are made by the client.

7. SAMPLE CUSTODY

7.1 General

Sample custody procedures are necessary to provide for and maintain data validity and control. Samples must be under the control of the laboratory at all times after their transfer from the delivery personnel. A chain-of-custody program lends significant legal support to the results generated.

A sample is in someone's custody if it is in any one of the following states:

a. In actual physical possession
b. In view, after being in physical possession
c. In physical possession and locked up so that no one can tamper with it
d. In a secured area, restricted to authorized personnel.

7.2 Field Sampling Procedures

All aspects of sample custody in the field will be performed by the sample collector or their designee. Whenever the laboratory personnel are to become involved in sampling, they will follow appropriate chain-of-custody procedures such as those found in SW-846.

7.3 Transfer of Custody

Samples collected and delivered to the laboratory will remain in the custody of the delivery personnel until delivery to the laboratory sample custodian. The transfer of custody will be completed by signing of the chain-of-custody form by the sample delivery person and the receiving laboratory sample custodian. ATEC will supply to the client, upon request, the ATEC chain-of-custody forms prior to sampling. (See Form 7.3-A)

7.4 Laboratory Custody Procedures

All laboratory personnel will endeavor to follow specific procedures when handling samples in the laboratory. All samples will be handled by a minimum number of personnel for the shortest amount of time possible keeping in mind the attributes of efficiency and effectiveness. This manner of handling should maintain sample integrity.

The ATEC Sample Custodian or his alternate is responsible for receiving all samples delivered to the laboratory. The sample custodian will acknowledge the receipt of the samples

by signing and dating the chain-of-custody forms. If chain-of-custody forms are not provided with the samples, the sample custodian will provide documentation that no chain-of-custody forms were provided.

The sample custodian will maintain a log of samples received including the following information:

a. the name of the person delivering the sample.
b. the name of the person receiving the sample.
c. the date and time sample was received.
d. the source of the sample.
e. the sample identification and laboratory numbers.
f. the condition of the sample as received.
g. comments pertinent to the sample's integrity.

Any problems encountered or concerns about sample handling will be documented by the sample custodian when noticed or brought to his attention. This documentation will become a part of the final report to reduce the laboratory liability due to poor sampling and handling procedures utilized by others.

The sample custodian will ensure that all samples will have labels placed upon them for identification purposes in the laboratory.(See Form 7.4-A) The sample custodian will further ensure that any sample requiring special handling or having unusual physical characteristics is properly stored and maintained prior to analysis.

The laboratory has set aside a secure sample storage area. This area is to be kept clean, dry, refrigerated, and secure at all times. The laboratory has also set aside a similar area that is non-refrigerated. It also is to be kept clean, dry and secure at all times.

The laboratory will be maintained as an area restricted to authorized personnel only. Laboratory security is to be maintained on a 24-hour a day basis.

Laboratory personnel are responsible for the custody of the samples transferred to them. They will be prepared to testify that these samples were in their custody based upon the definition of sample custody. Intra-laboratory chain-of-custody forms are used to maintain control of samples within the laboratory until analysis is completed.(See Form 7.4-B) Subcontractors or other ATEC laboratories are required to sign ATEC chain-of-custody forms to transfer samples into their custody.

The sample custodian will be responsible for sample disposal

once the analyses are complete and the sampler has been notified and concurs. The date, time, and method of disposal will be documented by the sample custodian and filed for any future use.

All chain-of-custody forms, data sheets, reports, and other documentation associated with a sample will be filed and maintained for five years. This information may be stored in hard copy form or on other media, as the laboratory determines is best for its purposes. The information will be released to authorized personnel only.

PROJ. ... JEC ... ME

CLIENT

SAMPLERS: *(Signature)*

SAMPLING METHOD

LABORATORY ANALYSIS

SAMPLE I.D. NO.	DATE	TIME	COMPOSITE	GRAB	WATER	SOIL		FILTERED	ACIDIFIED	ICED		NUMBER OF CONTAINERS	LAB I.D. NUMBER	VOLATILE ORGANICS	BTX & E	TOTAL HYDROCARBONS	PCB'S	E.P. TOXIC METALS	TOTAL METALS (6)	IGNITABILITY		SAMPLE LOCATION / REMARKS

ATEC Environmental Services

Division of ATEC Associates, Inc.
5150 East 65th Street
Indianapolis, Indiana 46220-4871
(317) 849-4990, FAX # (317) 849-4278

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Project Manager / Phone #:

SECTION NO.: F
REVISION NO.: 0
DATE: 8/25/98
PAGE 4 OF 6

ATEC ENV/ANALYTICAL TESTING DIV.
Job #:_____ Date _____
Sample #: _____
Analysis: _____
Sampler: _____
Preservation: _____

IN HOUSE CHAIN OF CUSTODY

ATEC LAB NO._____

DATE RECEIVED_____ CLIENT JOB NO._____

MATRIX_____ TOTAL # OF SAMPLES_____

EXTRACTION REQUIRED (Y OR N)___ORGANIC Y/N___INORGANIC Y/N_____

SAMPLES PLACED IN COOLER: DATE_____TIME_____by_____

RELINQUISHED BY:	RECEIVED BY:(AREA)	DATE/TIME

SAMPLES/EXTRACTS PLACED IN POST ANALYSIS STORAGE BY_____

DATE_____TIME_____

SAMPLES/EXTRACTS DISPOSED OF BY_____

DATE_____TIME_____

METHOD OF DISPOSAL_____

APPENDIX F

STANDARD OPERATING PROCEDURES FOR AN HNu MODEL PI 101 PHOTOIONIZATION ANALYZER

STANDARD OPERATING PROCEDURE FOR AN HNU MODEL PI 101 PHOTOIONIZATION ANALYZER

1.0 PARAMETER TO BE MEASURED

The HNu Photoionization Analyzer (HNu) will be used to measure volatile organic compounds (VOCs).

2.0 RANGE OF MEASUREMENT

The range of measurement of the HNu is 0.1 to 2000 ppm (parts per million by volume). However, the range of 0.1 to 200 ppm will be used for this project, unless VOC concentrations greater than 200 ppm are encountered.

3.0 LIMIT OF DETECTION

According to the HNu manual, "Instruction Manual, Trace Gas Analyzers, HNu Model PI 101" (1985), the limit of detection of the HNu is 0.1 ppm. The detection limit will be checked by plotting the three-point calibration results as "Actual ppm Reading" vs. "Calibration Gas Level ppm." The point where the resulting line intersects the x axis is the detection limit.

4.0 SAMPLE MATRICES

The sample matrices for which the HNu will be used at the Lenz Oil site are soil gas, soil, sediment, surface water, bedrock, and ground water.

5.0 PRINCIPLE, SCOPE, AND APPLICATION

The HNu is a portable instrument that uses the principle of photoionization to detect, measure, and provide a direct reading of the concentration of a variety of trace gases in the atmosphere. This process involves the absorption of ultraviolet light by gas molecules, leading to ionization. The sensor's ultraviolet light source emits photons with an energy level high enough to ionize many trace species, especially organics, but not high enough to ionize the major components of air (O_2, N_2, CO_2, CO, or H_2O). A chamber containing a pair of electrodes is exposed to the light source. Ions formed by the absorption of photons are driven to the collector electrode producing a current that is measured, and the corresponding concentration is displayed on the meter in parts per million.

The HNu will be used to obtain semiquantitative soil gas data in the field. These data will assist the field sampling personnel in immediately determining whether additional sampling locations will be needed or if any other modification to the sampling program is needed. For example, if a high reading is obtained at the edge of the sampling grid originally specified in the Sampling and Analysis Plan, field personnel would extend the sampling grid to delineate the extent of the elevated HNu readings.

The HNu will also be used in the field to obtain semiquantitative VOC concentration readings from on-site soil. These data will be used in the field to select soil for laboratory analysis. Qualitative VOC concentration data will be collected from off-site soil, sediment, surface water, bedrock, ambient air, and ground water samples. These data will be used to establish proper levels of personnel protection. HNu data from soil and bedrock samples will be considered when selecting appropriate screen depths for the deep monitoring wells.

6.0 INTERFERENCES AND CORRECTIVE ACTIONS

There are no interferences except for physical ones, such as a dirty lamp. See Attachment A on troubleshooting taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101."

7.0 SAFETY PRECAUTIONS

The following warnings are listed in the HNu manual:

- Do not look at the light source from closer than 6 inches with unprotected eyes. Observe only briefly. Continued exposure to ultraviolet energy generated by the light source can be harmful to eyesight.

- Extreme care must be taken in the handling of gas cylinders. Contents are under high pressure. In some cases, the contents may be

hazardous. Many gas suppliers will provide data sheets for the mixtures upon request.

- Never open the valve on a gas container without a regulator attached.

- Turn the function switch on the control panel to the OFF position before disassembly. Otherwise, high voltages of 1200 V DC will be present.

Also refer to the site Health and Safety Plan for site safety procedures.

8.0 SAMPLE SIZE, COLLECTION, PRESERVATION, AND HANDLING

The HNu probe will be attached directly to the soil gas sampling train to obtain a reading. Soil collected in split-spoon or continuous soil samplers will be screened by scanning the surface of the soil with the HNu probe. Bedrock cores, collected in NX-core barrels, will be scanned using the same procedure. The surface of sediment and soil samples collected with a bucket auger, trowel, or Eckman dredge will be screened with an HNu by scanning it with the probe tip. The top of monitoring well casings and ground water removed from the monitoring wells will be screened by scanning the top of the well or the surface of the water with the HNu probe. Therefore, no actual sample collection will be performed; and a discussion of sample size, collection, preservation, and handling is not applicable.

9.0 APPARATUS AND MATERIALS

The HNu meter to be used at the Lenz Oil Site consists of a 10.2 eV probe, a readout assembly, and a battery charger. These items are shown in Figures 1-1, 1-3, and 1-4, which were taken from the HNu manual. No other equipment is needed to perform VOC screening with the HNu.

10.0 ROUTINE PREVENTATIVE MAINTENANCE

The following sections describe the tasks that will be performed to maintain proper performance of the HNu meter.

10.1 Battery Charging

The following steps are used to charge the battery:

- Prior to leaving the site at the end of the day, insert the mini phone plug of the charger into the jack on the left side of the meter.
- Connect the charger to a 120 V AC outlet.
- Turn the function switch to the battery check (BATT) position to ensure that the charger is functioning. (The meter should indicate full scale if the charger is working properly.)
- Leave the function switch in the OFF position for the duration of the charging.

- When the charging period ends (i.e., in the morning), turn the function switch to OFF, unplug the charger, and then remove the mini phone plug from the meter.

10.2 UV Lamp and Ion Chamber Cleaning

The lamp and ion chamber will be cleaned monthly, or sooner if meter readings are low, erratic, unstable, nonrepeatable, drifting, or showing apparent moisture sensitivity. The following steps are followed when cleaning the unit:

- Turn the function switch to the OFF position.

- Disconnect the probe from the readout assembly.

- Remove the exhaust screw at the base of the probe, grasp the end cap in one hand and the probe shell in the other, and then gently pull to separate the lamp housing from the shell. (Refer to Figure 5-1, taken from the HNu manual.)

- Loosen the screws on the top of the end cap; then separate the end cap and ion chamber from the lamp and lamp housing. Be careful that the ion chamber does not fall out of the end cap or that the light source does not fall out of the lamp housing.

- Holding one hand under the end cap, lightly tap on the top of the cap to remove the ion chamber.

- Slide the light source out of its housing by tilting the housing slightly (see Figure 5-2, taken from the HNu manual).

- Clean the lamp window, if necessary, using a gentle detergent. Rinse with warm water or a damp tissue. Dry with a clean tissue.

- To clean the ion chamber, remove the outer Teflon ring and the four screws holding the retaining ring. Carefully move the retaining ring aside and remove the screen. Use a tissue (dry or wetted with methanol) to clean off any deposits. Dry the chamber completely.

- Reassemble the probe by first sliding the lamp back into its housing.

- Place the ion chamber on top of the lamp housing, making sure that the contacts are properly aligned.

- Place the end cap on top of the ion chamber, and replace the two screws, tightening just enough to seal the O-ring.

- Line up the pins on the base of the lamp housing with those inside the probe shell and gently slide together.

- The end cap should meet the probe shell evenly. If it does not, repeat the previous step.

- Align the 12-pin probe connector to the readout assembly. Reconnect with a twisting motion until a click occurs. Check that the high voltage microswitch is properly depressed.

- Check the meter performance. If it is still not satisfactory, the lamp should be replaced as described in Section 10.3.

10.3 Lamp Replacement

Since lamp replacement requires subsequent recalibration of the meter, the HNu will be sent back to the supplier should the lamp need replacing.

10.4 Readout Assembly

Any necessary maintenance on the readout assembly will be performed by the supplier.

11.0 REAGENTS AND CALIBRATION STANDARDS

A three-point calibration will be performed by the supplier using isobutylene in air at concentrations of 50, 100, and 150 ppm. A one-point calibration check will be completed in the field by using a 100 ppm mixture of isobutylene in air.

12.0 CALIBRATION PROCEDURES

The three-point calibration will be performed by the HNu meter supplier using the standards listed in Section 11.0. The steps for the three-point calibration are as follows:

- Turn the function switch to BATT to check that the battery is fully charged. The needle on the meter should go to the green zone.

- Turn the function switch to on, and look at the end of the probe for a purple glow, which indicates that the light source is on. Do not look directly at the lamp itself.

- Turn the function switch to STANDBY. Turn the zero adjustment until the meter needle is at zero.

- Turn the function switch to 0-200. Insert the probe into the tee connected to the 100 ppm calibration gas cylinder and rotameter, as shown in Figure 2, taken from "Operational

Procedure for HNu Model PI 101 Photoionization Analyzer."

- Open the valve on the cylinder so that the rotameter indicates a flow.
- With the SPAN set at 9.8, adjust gain potentiometer, R48, on the power supply board of the readout assembly to obtain a meter reading of 55 ppm (benzene equivalent of 100 ppm isobutylene).
- Turn the function switch to STANDBY and reset zero, if necessary.
- Connect the 150 ppm calibration gas cylinder to the probe, set the function switch to 0-200, and record the meter value.
- Repeat the last two steps with the 50 ppm calibration gas cylinder.
- The meter should read within 15% of 28 ppm and 83 ppm, which are the benzene equivalents of 50 and 100 ppm isobutylene, respectively. If the values are not within those ranges, the instrument should be recalibrated with the 100 ppm gas. Consistent failure may indicate the need for cleaning of the unit.

The one-point field calibration check will be performed as described in Attachment B, taken from the HNu manual. According

to the manufacturer of the HNu, the meter should remain in linear calibration as long as the midpoint calibration gas concentration can be matched by adjusting the span, and the span value is greater than 3.0. Therefore, if the span value goes below 3.0, the meter will be sent to the supplier for recalibration.

13.0 SAMPLE PREPARATION

No sample preparation is needed for VOC screening with an HNu.

14.0 OPERATION OF THE HNU METER

The following procedures will be followed each day that the HNu is used:

- Unclamp the cover from the main readout assembly; and remove the probe, handle, and cable from the cover.
- Connect the probe cable to the 12-pin socket on the readout assemble panel by carefully aligning the plug, inserting, and then turning until a distinct click is felt.
- Screw the probe extension into the probe end cap.
- Turn the function switch to BATT to check that the battery is fully charged. The needle on the meter should go to the green zone.

- Turn the function switch to the STANDBY position. Turn the zero adjustment until the meter needle is at zero.

- Calibrate the meter using a midlevel calibration, as described in Section 12.0. Record all calibrations in the field log book.

- Turn on the functional switch to 0-20, and determine the background concentration (away from the contaminated area).

- Scan the surface of the appropriate sampling location with the HNu probe and select the appropriate scale (0-20, 0-200 or 0-2000) to obtain a reading by turning the function switch.

- Take a reading and record it in the field log book.

- At the end of the day, (1) connect the HNu to the battery charger as described in Section 10.1; or (2) unplug the HNu probe, place it in the main readout assembly cover, and clamp the cover onto the readout assembly.

15.0 DATA TREATMENT

The data taken from the HNu meter needs no treatment.

16.0 DATA DELIVERABLES

The following items will be included in the final data report:

- Case narrative, including problems encountered and corrective action taken;
- Summary of initial calibration and continuing calibration check results;
- Summary of sample data; and
- Field log book, including serial number(s), maintenance and repair history over the duration of the project, name(s) of analyst(s), parameters measured, instrument settings, and any other comments.

17.0 QUALITY CONTROL

Field personnel will follow the steps in this SOP carefully to ensure that the HNu readings they obtain are of high quality. All calibrations, maintenance activities, screening results, and corrective actions will be documented in the field log book.

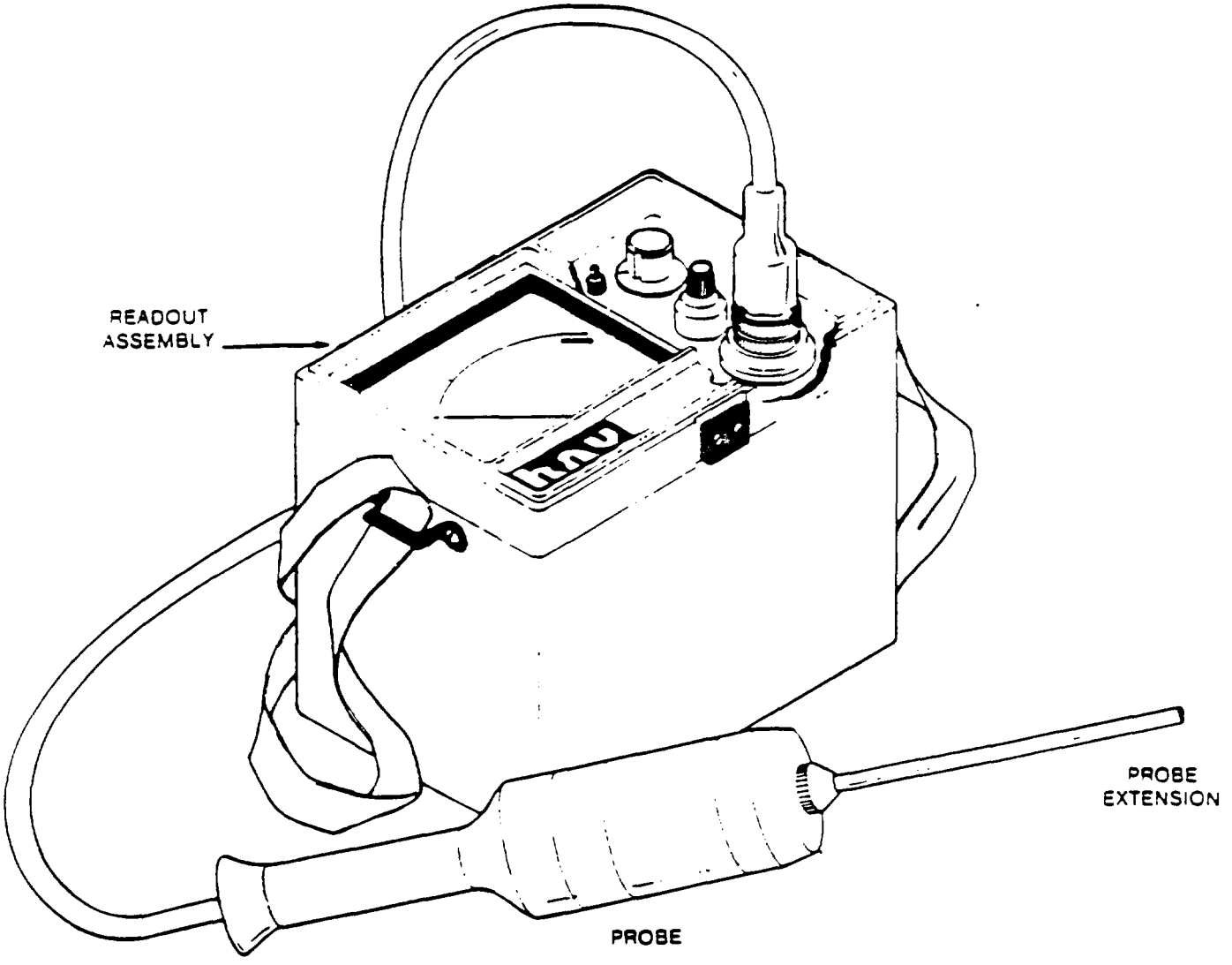
18.0 REFERENCES

- "Guidelines for the Preparation of Standard Operating Procedures (SOPs) of Field and

Laboratory Measurements," USEPA Region V, March 16, 1989.

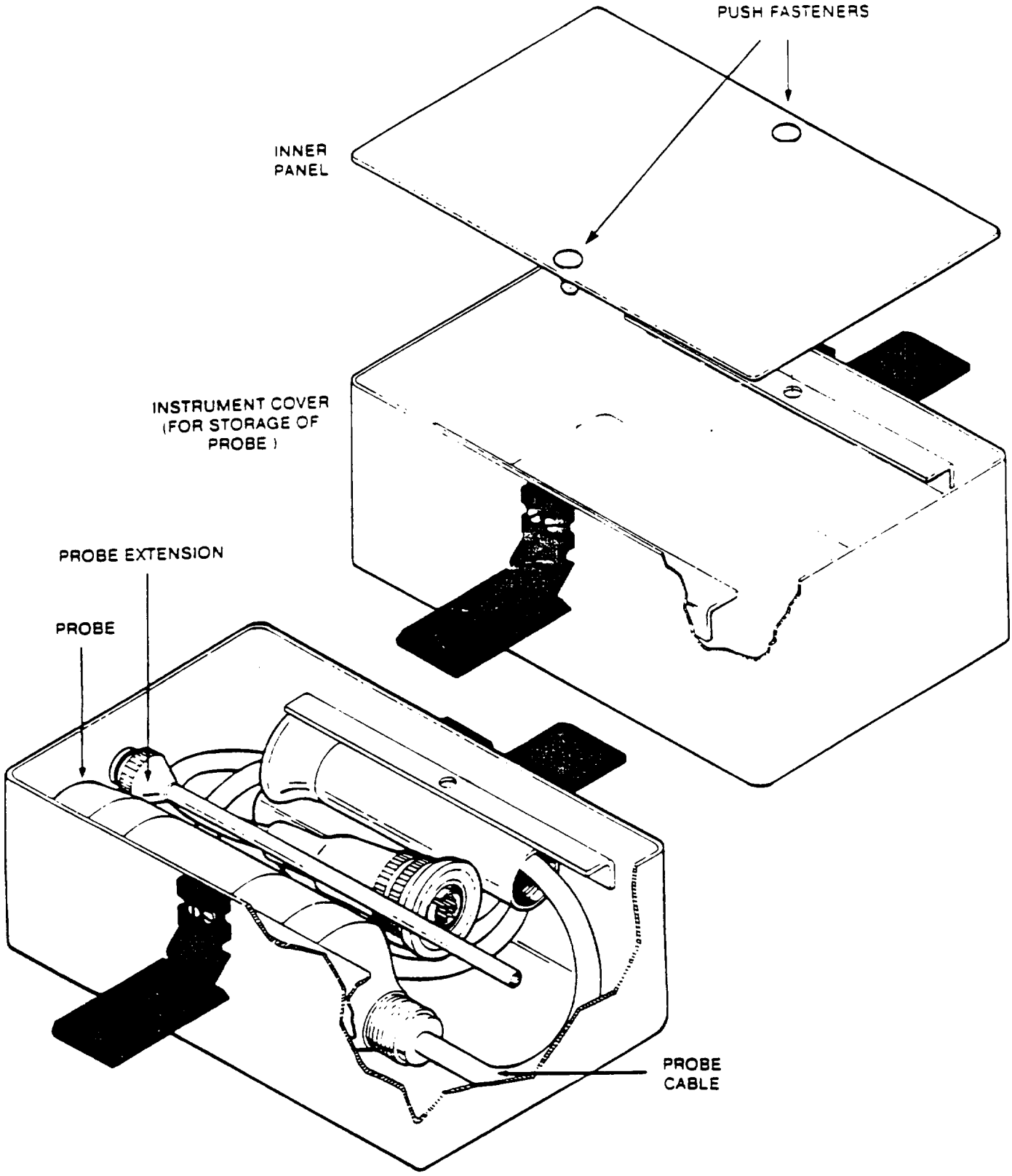
- "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA, December 1985.

- Tsai, Cheng-Wen, "Operational Procedure for HNu Model PI 101 Photoionization Analyzer," USEPA Region V.



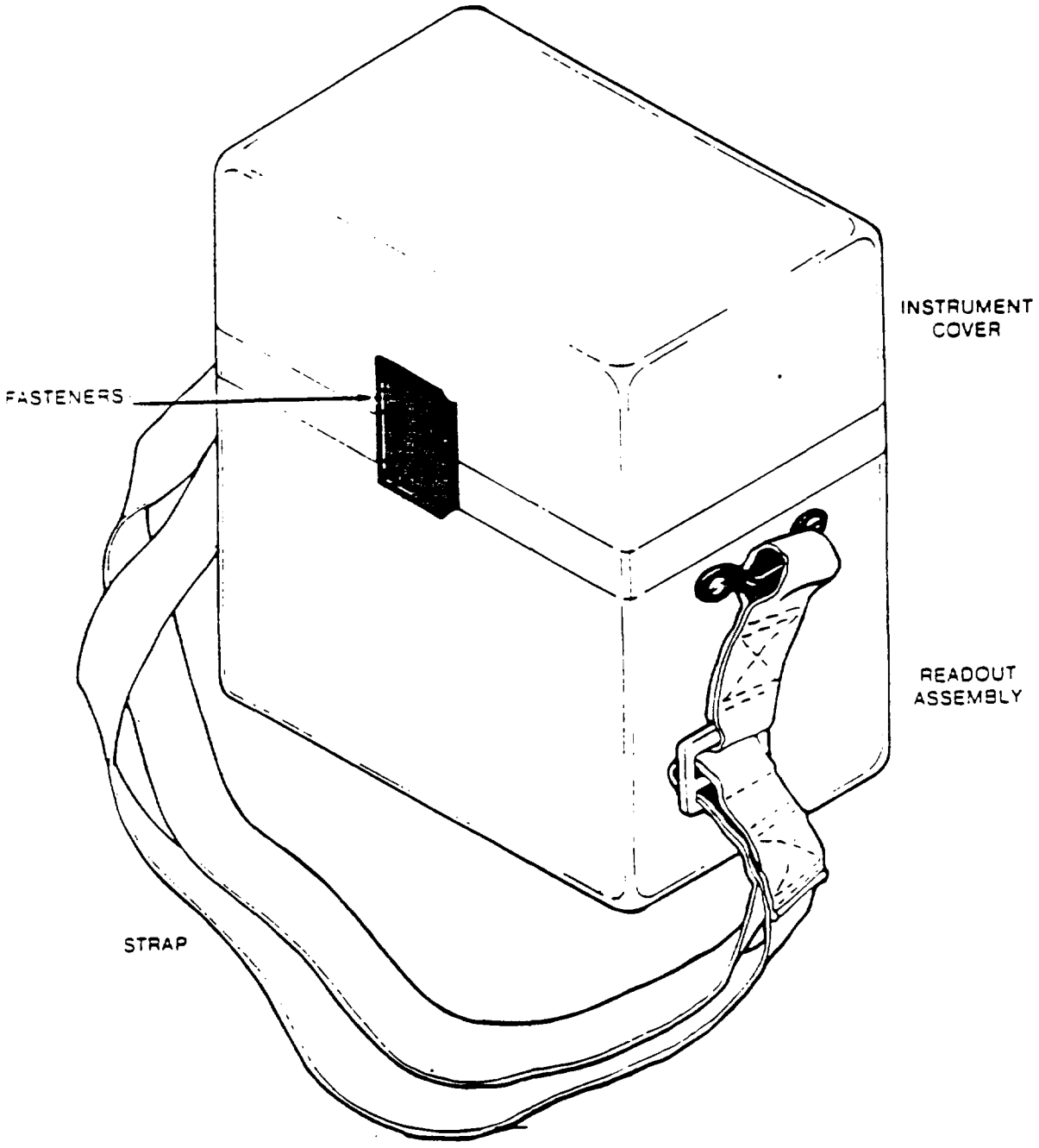
Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December 1985.

FIGURE 1-1
TRACE GAS ANALYZER
OPERATING CONDITION



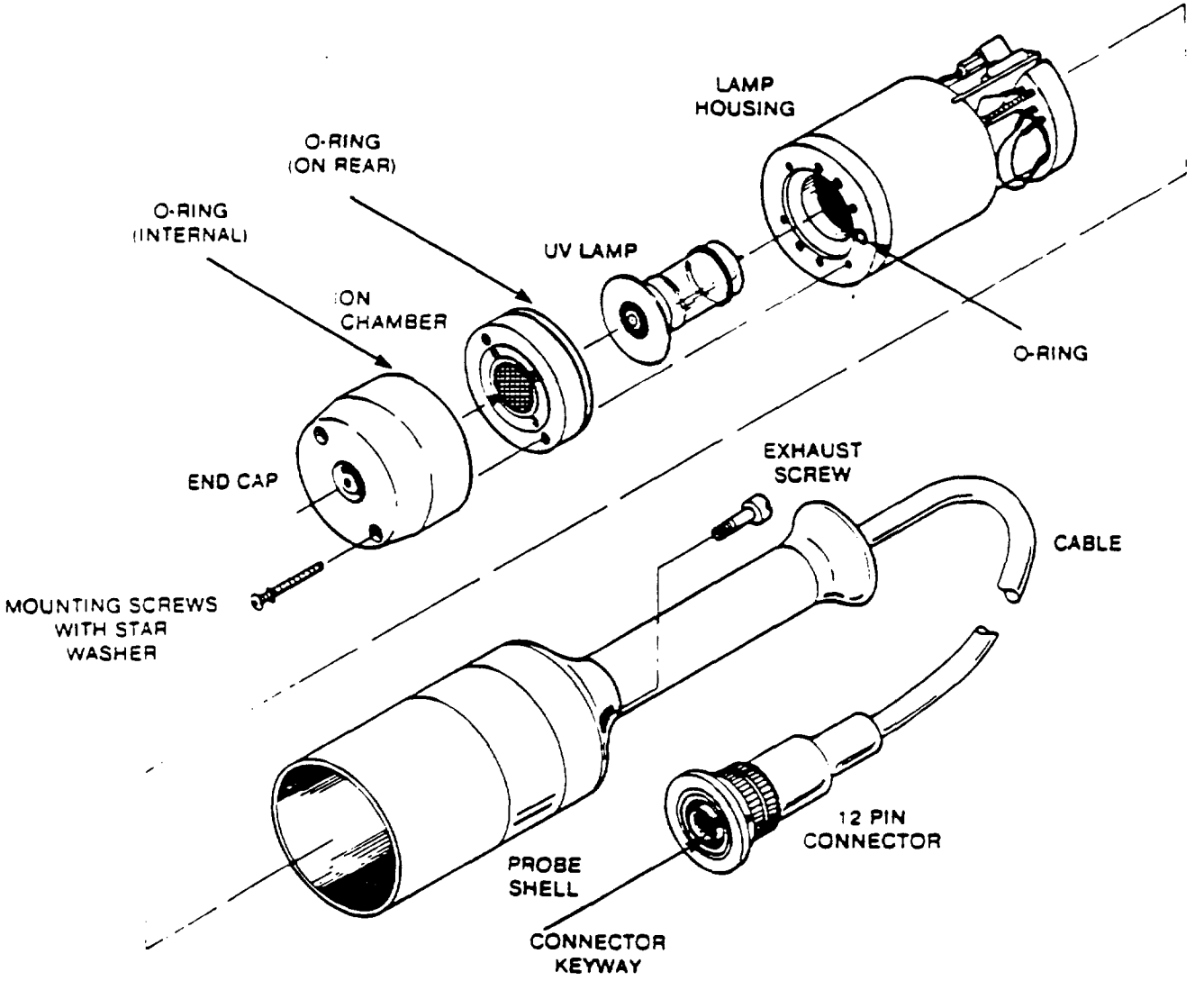
Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December, 1985.

FIGURE 1-3
PROBE STORAGE
INSTRUMENT COVER



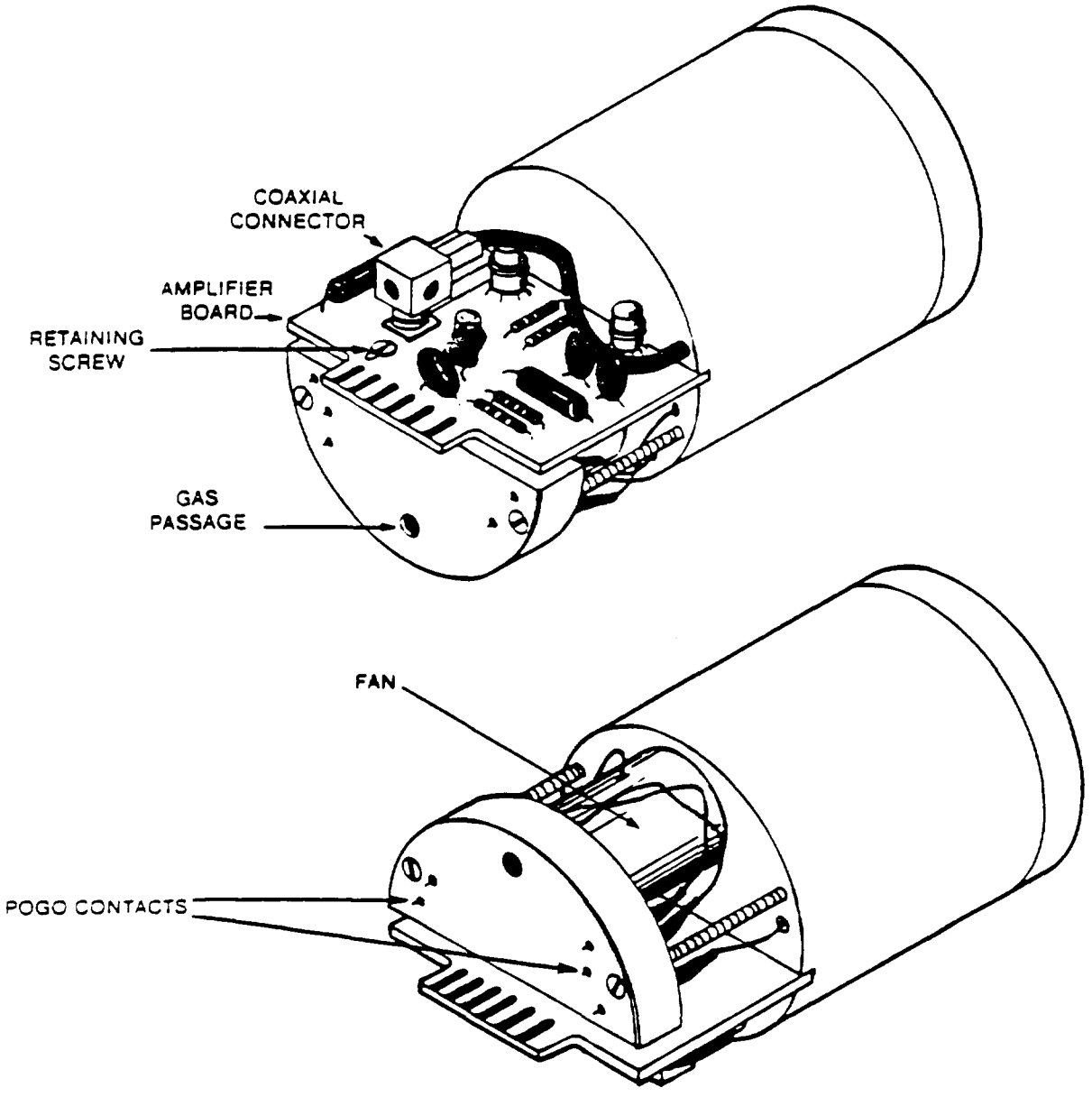
Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December, 1985.

FIGURE 1-4
TRACE GAS ANALYZER
STORED CONDITION



Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December 1985.

FIGURE 5-1
PROBE ASSEMBLY



Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December, 1985.

FIGURE 5-2
LAMP HOUSING ASSEMBLY

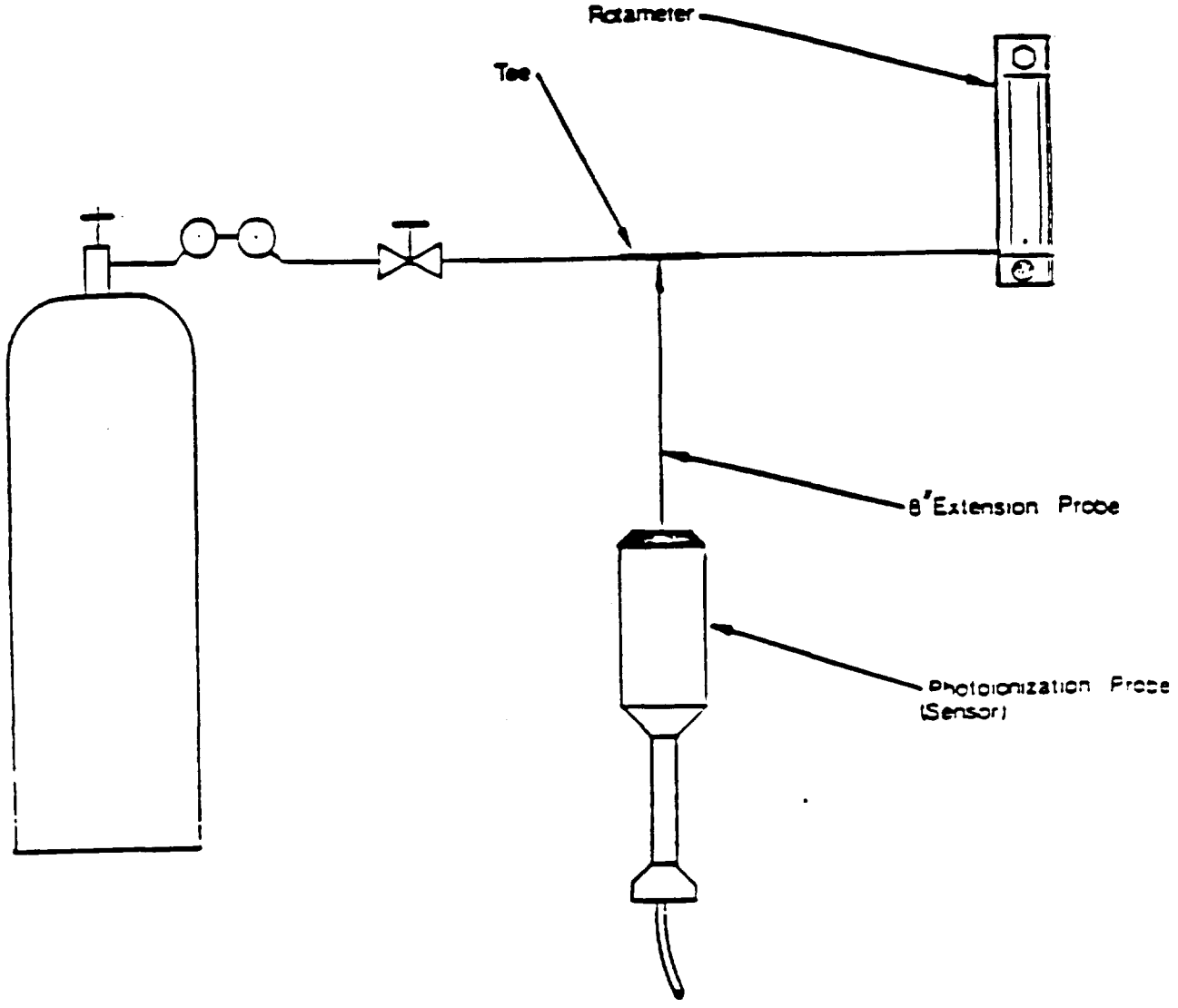


FIGURE 2 RECOMMENDED CALIBRATION PROCEDURE FOR PHOTOIONIZATION ANALYZER

Taken from "Operational Procedure for Hnu Model PI 101 Photoionization Analyzer," by Cheng-Wen Tsai, USEPA Region V.

Attachment A

SECTION 6

TROUBLESHOOTING

6.1 INTRODUCTION

The initial step of any troubleshooting is a thorough visual inspection to look for possible loose or open connections, shorts, dust or other obvious conditions.

Detailed troubleshooting for fault location and correction is accomplished by steps outlined in the following:

Troubleshooting Data	Table 6-1
Pad Data, Power Supply PCB	Table 6-2
Pad Location, Power Supply PCB	Figure 6-1
Pin Data, Amplifier PCB, P2/J2	Table 6-3
Pin Data, Probe Cable, P3/J3	Table 6-4
Pin Data, Alarm Cable, P6/J6	Table 6-5

Disassembly and reassembly as may be required for checking the equipment or replacing parts are described in Chapter 6.

WARNING

Turn the function switch on the control panel to the OFF position before disassembly. Otherwise high voltage of 1200 V DC will be present.

WARNING

Do not observe the light source closer than 6 inches with unprotected eyes. When necessary, observe only briefly. Continued exposure to ultraviolet energy generated by the light source can be harmful to eyesight.

WARNING

Use great care when operating the analyzer with the readout assembly outside its case due to the presence of 1200 V DC.

If, after following the steps cited in this section, the analyzer is not functioning properly, contact the HNU Service Dept. for assistance. (Phone: (617) 964-6690).

Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December, 1985.

TABLE 6-1

TROUBLESHOOTING DATA

Symptom	Probable Cause	Corrective Action
1. Meter indicates low battery	a. Blown fuse (Fuse F1, 2A, 5-3)	1) Check fuse. If blown, check for evidence of shorts in wiring, then replace fuse.
	b. Bad connections	1) Check wiring connections. Resolder poor or bad connections.
	c. Broken meter movement	1) Tip instrument rapidly from side to side. Meter needle should move freely, and return to zero. If faulty, replace with new meter.
	d. Battery dead	1) Disconnect battery and check with volt-ohmmeter. Replace if dead.
	e. Battery charge low	1) Recharge battery, check meter with function switch in BATT position to ensure the charger is operating properly (see Table 2-1, BATT)
2. Low battery	a. Power supply defective	1) Check power supply voltages (see Table 6-2 and Figure 6-1). If in error, replace power supply assembly.
. UV lamp not ON	a. High Voltage interlock (Microswitch S2) at probe cable connector on readout assembly not operating	1) Check by applying pressure to switch plunger with cable in place. Adjust the screw on side of cable connector, if required, to increase throw of switch plunger.
	b. High voltage supply out or faulty	1) Check high voltage output on power supply board (pad 22). If voltage not correct, (see Table 6-2) replace power supply board.

TABLE 6-1 cont.

	c. Lamp not making proper connection with high voltage contacts.	1) Remove lamp, clean and tighten contacts, reinstall lamp.
	d. Lamp faulty	1) Replace lamp.
	e. Short in high voltage lines	1) Check wiring from power supply board to probe cable connector (J3 pin D) to UV lamp contacts (D1). Remove any shorts.
4. Fan not running	a. Fan stuck	1) Disassemble probe and clean passages and fan by blowing out dust. To remove larger particles use cotton swab, Q-tip or equal. Use care to not damage impellor rotor or blades. For disassembly see Section 5.5.
	b. Fan connections faulty	1) Check for wiring connections at fan motor and at probe cable connector (J3 pins A and C). Repair as required.
	c. Low or dead battery	1) Check battery output (power supply board, pad 9). Recharge or replace battery as required.
	d. Fan voltage not correct	1) Check fan voltage (power supply board pads 19 and 21, probe cable pins A and C). If not correct, replace power supply board.
		2) If fan voltages correct replace fan.
5. Meter does not respond	a. Dirty or open probe connection	1) Clean and tighten or resolder connections in probe.
	b. Broken meter	1) See 1-c-1 above.
	c. Dirty or open connections to meter	1) Clean and tighten connections at meter.
	d. Low or dead battery	1) See 4-c-1 above.
	e. Blown fuse	1) See 1-a-1 above.

TABLE 6-1 cont.

6. Meter does not return to zero in STANDBY	a. Broken meter movement	1) See 1-c-1 above.
	b. Dirty or open connections to meter	1) See 5-c-1 above.
	c. Dirty or open connections in probe	1) See 5-a-1 above.
	d. Zero adjust faulty	1) Rotate zero adjust pot (see Fig. 2-1) (R50, Fig. 4.6). Check pot output at meter probe connector (J3 pins B and L). If voltage does not vary, replace zero adjust pot.
	e. Amplifier faulty	1) Rotate zero adjust pot. Check amplifier output at probe connector (J3 pin H) or observe meter. If voltage level on meter does not respond, replace amplifier board
	f. Ion chamber shorted	1) Clean ion chamber. (see Section 5.2). Recheck for return to zero in STANDBY.
		2) Replace ion chamber.
7. Meter readings, high or low	a. Incorrect calibration	1) Recalibrate (see Section 3).
	b. Lamp dirty	1) Clean lamp (see Section 5.2)
	c. Contamination in ion chamber.	1) Clean ion chamber. (see Section 5.2)
	d. Power supply board faulty	1) Check power supply board outputs (pads 17, 20 and 22 (Table 6-2). If voltages not correct, replace power supply board.
	e. Dirty or loose connections	1) Clean or tighten connections at amplifier board, probe cable, and meter.

TABLE 6-1 cont.

8. Meter erratic, unstable or non-repeatable	a. Loose cable connection	1) Check cable connection at control panel. Observe meter. Tighten cable as required.
	b. Dirty or loose meter connections	1) Check meter connections. Clean and tighten as required.
	c. Contamination in ion chamber	1) Clean ion chamber. (see Section 5.2).
	d. Power supply board faulty	1) See 7-d-1 above.
	e. Unstable or noisy lamp	1) Observe lamp. (Important- see WARNING in Section 6.1). If operation not steady, replace lamp.
	f. Function switch in high gain, most sensitive position	1) Unstable meter operation is common with function switch in most sensitive position. Turn switch to less sensitive position if desirable.
	g. Fan not operating properly	1) Replace fan.
	h. Gas flow slow or stopped	1) See 4-a-1 above.
	i. Meter contacts dirty or loose	1) Clean and tighten contacts.
9. Drifting meter or apparent moisture sensitivity	a. Ion chamber contaminated	1) Clean ion chamber, (see Section 5.2).

TABLE 6-2

PAD DATA, POWER SUPPLY PCB

Pad No.	Signal Name	Voltage (V DC)
1	Battery positive (+)	0
2	Ground	0
3	Battery charger (+)	0
4	Low Battery Indicator	
5	Low Battery Indicator	
6	Hi-Volt Relay Disconnect	-12
7	Battery Charger (-)	-11 to -15
8	Battery Negative (-)	-11 to -15
9	Battery Negative (-)	-11 to -15
10	Hi-volt Relay Disconnect	0 or -12
11	Amplifier Signal	0 to -5
12	Signal divider for span control	"
13	" " " " "	"
14	" " " " "	"
15	" " " " "	"
16	" " " " "	"
17	Ion Chamber accelerating voltage	+180
18	Zero adjust voltage power	+18 to +21
19	Fan Motor	-10.6 V nominal (see NOTE 2)
20	Amplifier Power	-9.5 to -10.5
21	Fan Motor	-14.5 nominal (see Section 4.8)
22	UV Lamp	up to -1200 (see Section 4.8)
23	Output Signal to Meter	0 to -5
24	Battery Check Voltage	-11 to -15
25	Not Used	---
26	Signal Feedback	0 to -5
27	Ground	0
28	Ground	0
29	Not Used	---
30	Ground	0
31	Ground	0
32	Alarm set power	+10
33	Alarm set power	+7

NOTES: 1. For Pad location, see Figure 6-1.

2. Differential potential for fan motor between pads 19 and 21 will be between 2.6 and 3.6 V DC.

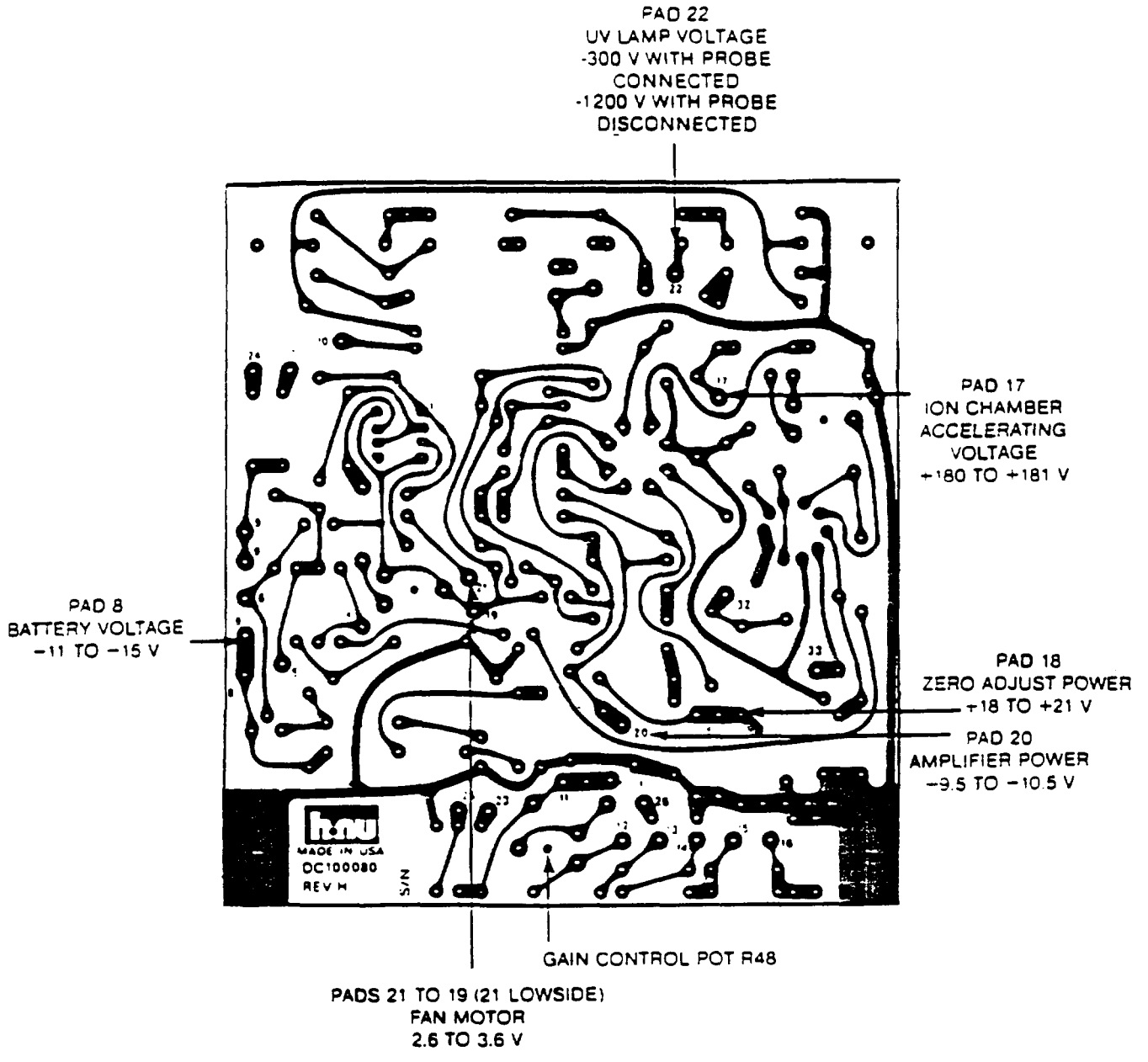


FIGURE 6-1
PAD LOCATION, POWER SUPPLY PCB

TABLE 6-3

PIN DATA, AMPLIFIER PCB, P2/J2

Pin #	Signal Name	Voltage (V DC)
	Ground	0
	Span Control Setting	varying
	Zero Adjust	varying
	Amplifier Power	-9.5 to -10.5
	Amplifier Signal	0 to -5.0
	Zero Adjust Voltage	+18 to +21
	Zero Adjust Voltage	varying

TABLE 6-4

PIN DATA, PROBE CABLE, P3/J3

Pin #	Signal Name	Voltage (V DC)
A	Fan Motor	-14.5 nominal (see NOTE)
B	Zero Adjust	varying
C	Fan Motor	-10.6 nominal (see NOTE)
D	UV Lamp	up to -1200 (see Section 4.8)
E	Amplifier Signal	0 to -5.0
F	Ground	0
G	Span Control Setting	varying
H	Ground	0
J	Zero adjust Voltage	+18 to +21
K	Zero Adjust	varying
L	Ion Chamber accelerating voltage	+180
M	Amplifier Power	-9.5 to -10.5

NOTE: Differential potential for fan motor between pads 19 and 21 will be between 2.6 and 3.6 V DC.

TABLE 6-3

PIN DATA, ALARM CABLE P6/J6

Pin #	Signal Name	Voltage (V DC)
1	Alarm set pot, high end	+5.1
2	Alarm set power	+7
3	Alarm power	0 or -11 to -15
4	Alarm set	+0.02 to +5.1
5	Alarm board power	+10
6	Amplifier power	-9.5 to -10.5
7	Alarm set pot, low end	+0.023
8	Ground	0
9	Amplifier signal	0 to -5.0

Taken from "Instruction Manual, Trace Gas Analyzer, HNu Model PI 101," HNu Systems, Inc., Newton, MA; December, 1985.

8.2 CALIBRATION CHECKING WITH ISOBUTYLENE

The calibration of the analyzer can be rapidly checked by the use of an HNU small disposable cylinder containing isobutylene (HNU pn 101-350) with a regulator (HNU pn 101-351).

At the factory, the analyzer is first calibrated on the desired gas standard at the specified concentration. Then a measurement is made with isobutylene.

The ppm reading along with the span setting using isobutylene is recorded in the calibration report.

In service, the analyzer calibration can be checked and readjusted if necessary by using this cylinder and regulator as follows:

a. Connect the analyzer to the regulator and cylinder with a short piece (butt connection) of tubing as shown in Figure 8-1. The calibration gas in the cylinder consists of a mixture of isobutylene and zero air. Isobutylene is nontoxic and safe to use in confined areas. There are no listed exposure levels at any concentration.
   The regulator sets and controls the flow rate of gas at a value preset at the factory. This will be about 250 cc/min.
   It is important that the tubing be clean since contaminated tubing will effect the calibration reading.
   Do not use the cylinder below about 30 psig as readings below that level can deviate up to 10% from the rated value.
   Safely discard the disposable cylinder when empty.
   Do not refill this cylinder.
   It is against the law to transport refilled cylinders.

b. With the SPAN setting and the function switch at the same positions as listed in the Application Data Sheet or Calibration Report, open the valve on the cylinder until a steady reading is obtained.

c. If the reading is the same as the recorded data, the analyzer calibration for the original species of interest is still correct.

d. If the reading has changed, adjust the SPAN setting until the reading is the same.

e. Shut off the cylinder as soon as the reading is established.

f. Record and maintain this new SPAN setting. Then recalibrate the analyzer on the species of interest as soon as possible.

g. Whenever the analyzer is recalibrated, it is to be immediately checked with the small cylinder and the reading recorded. This can then be used for later checking in the field.

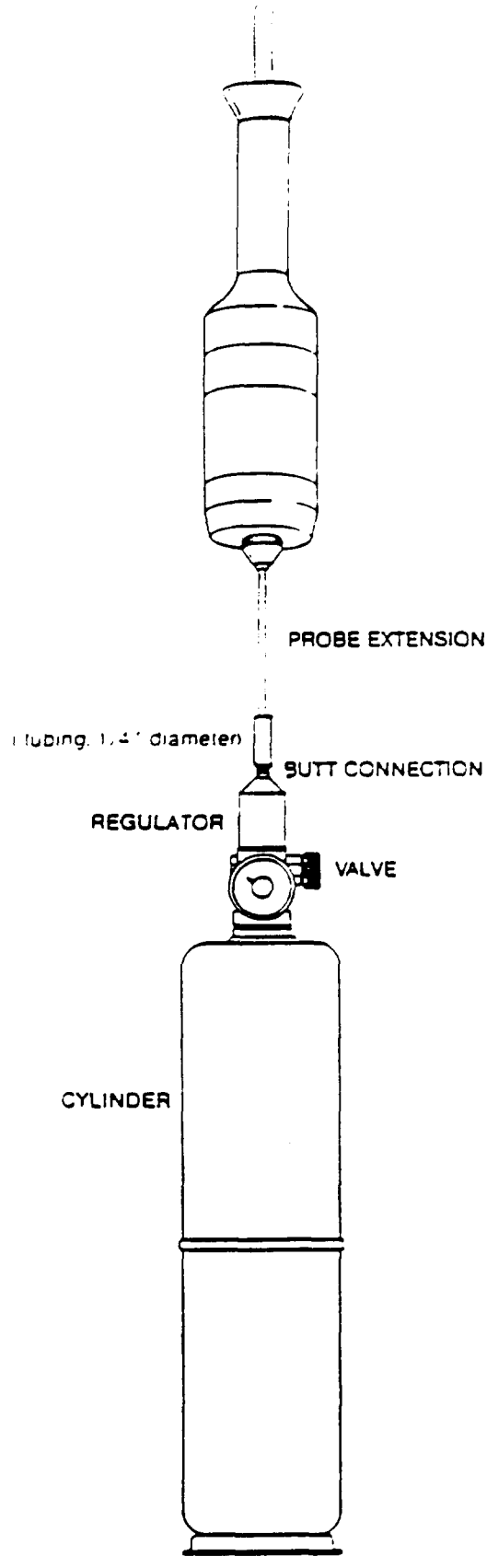


FIGURE 8-1
CALIBRATION CHECKING SET-UP

APPENDIX G

STANDARD OPERATING PROCEDURES FOR THE pH METER

Field Measurements of pH

Method: Electrometric measurement of pH

Sensitivity: 0.1 pH Unit

Optimum Range: 1 - 12 pH Units

Sample Measurement: On-site upon sample collection

Reagents and Apparatus:

1. pH meter (Orien Model 211 min-pH meter or equivalent)
2. Combination electrodes
3. Beakers or plastic cups
4. pH buffer solutions, pH 4, 7, and 10
5. Deionized water in squirt bottle
6. All glassware shall be soap and water washed, followed by two hot water rinses and two deionized water rinses.

Procedures

A. Calibration:

1. Place electrode in pH 7 buffer solution.
2. After allowing several minutes for meter to stabilize, turn calibraiton dial until a reading of 7.00 is obtained.
3. Rinse electrode with deionized water and place in pH 4 or pH 10 buffer solution.

   NOTE: When calibrating the meter for samples with pH < 8.00, use buffers 7 and 4; and, for samples with pH > 8.00, use buffers pH 7 and 10.

4. Wait several minutes and then turn slope adjustment dial until a reading of 4.00 or 10.00 is obtained.
5. Rinse electrode with deionized water and place in buffer pH 7. If meter

reading is not 7.00, repeat steps 2 - 5.

B. Sample Measurements:

1. calibrate the meter according the calibraiton procedure.

2. Pour sample into a clean beaker or plastic cup.

3. Place the electrode in the sample solution. Make sure the white KCl junction on side of electrode is in solution. The level of electrode solution shall be one inch above sample to be measured.

4. Record the reading along with the temperature of the solution in the field/laboratory logbook.

5. Rinse electrode with deionized water between samples. Recheck calibration with pH 7 buffer solution after every 5 samples.

6. Repeat step 2-5 for each sample.

Quality Control:

1. Recheck calibration with pH 7 buffer solution after every 5 samples. The reading shall not exceed 7.00 +0.01 pH unit.

2. If, during meter calibration or calibration check, the meter fail to read 4.00 or 10.00, something may be wrong with the electrode. The cause shall be investigated and corrected. If problem lies in the electrode, the electrode shall be replaced.

3. pH is temperature dependent analysis. Therefore the temperature of buffer and smaples shall be recorded. The difference of temperature between the buffer solutions and samples shall be within about 2^0C. For refrigerated or cooled samples, refrigerated or cooled buffer solutions shall be used to calibrate the meter.

4. When not in use, the electrodes shall be stored in pH 4 buffer.

5. Weak organic acids, inorganic salts, and oil and grease interferes the pH measurements. If oil and grease are visible, note it on the field logbook and data sheet. Clean the electrode with soap and water,, followed with 10% HCl. Then recalibrate the meter.

6. Before going into the field:

   The following preparations shall be performed:

   a. Check batteries;

b. Calibration at pH 7 and 4 to check the electrode.
c. Obtain fresh buffer solutions.

7. Following field measurements:

a. Report any problems;
b. compare with previous data;
c. Clean all dirt off meter and inside case;
d. Make sure electrode is stored in pH 4 buffer.

References:

1. EPA Method No.150.1, "Methods for Chemical Analysis of Water and Wastes" 1979, Revised 1983.

APPENDIX H

STANDARD OPERATING PROCEDURES FOR THE CONDUCTIVITY, SALINITY, AND TEMPERATURE METER

Field Measurements of Specific Conductance and Temperature

Method: Specific Conductance, umhos at 25°C

Detection Limits: 1 umho/cm at 25°C

Optimum Ranges: 0.1 - 100,000 umhos/cm

Sample Measurement: Measure on-site upon sample collection

Reagents and Apparatus:

1. Conductivity meter (YSI or equivalent) and electrodes
2. Deionized water in squirt bottle.
3. Stock potassium chloride soultion, 1.00 N : Dissolve 74.555 g of KCl in Milli-Q water and dilute to 1,000 ml in a 1-liter volumetric flask.
4. Standard potassium chloride solution, 0.0100 N : Pipet 10 ml of stock solution into 1,000 ml volumetric flask and dilute with milli-Q water to the mark.

Procedures:

1. With mode switch at off position, check meter zero. If it can not be zero, use meter screw and adjust to zero.
2. Plug probe into jack on side of meter.
3. Turn mode switch to red line, and turn red line knob until need aligns with red line on dial. Change batteries if it can not be aligned.
4. Totally immerse probe in sample. Note: Do NOT allow the probe to touch the sample container.
5. Turn mode switch to appropriate conductivity scale, X100, X10, or X1. Use a scale that will give a mid-range output on the meter.
6. Wait for the needle to stabilize (about 15 seconds) and record conductivity multiplying by scale setting in field logbook.
7. While gently agitating the probe, take sample temperature (°C) and record in field logbook.

8. Rinse probe with deionized water.

9. Calculate specific conductivity using the following equation:

$$G_{25} = \frac{G_T}{(1+ 0.02 (T-25))}$$

Where:

G_{25} = conductivity at 25°C, umhos/cm

T = Temperature of sample, °C

G_T = Conductivity of sample at temperature T°C, umhos/cm

10. Record specific conductivity and temperature in the field logbook, and on appropriate data sheet. Report results for the standard solution with each data set.

11. Record on field logbook which meter and probe were used.

Quality Control:

1. After use, the meter must be wiped clean as possible.

2. After returning to the laboratory, compare results with previous data, and report any problems encountered to the lab personnel.

3. Recheck calibration after every 5 samples.

References:

1. EPA Method No.120.1, "Methods for Chemical Analysis of Water and Wastes." 1979, revised 1983.

2. Standard Methods, 15th Edition.

APPENDIX I
STANDARD OPERATING PROCEDURE
FOR
SOIL GAS DATA VALIDATION

STANDARD OPERATING PROCEDURE
FOR
SOIL GAS DATA VALIDATION

The validation of the volatile organics in soil gas analytical results shall include the following procedures:

1. HOLDING TIME.
   The holding time from date of sample collection for sample tubes is 7 days for aromatic volatile compounds and 14 days for all other volatile compounds. If exceeded, all positive results shall be qualified as estimated (J) and all negative results as estmated detection limits (UJ). If the holding time exceeds 21 days, all positive results are qualified as estimated (J) and all negative results shall be qualified as unusable (R).

2. BLANKS.
   This category shall include field, reagent and method blanks.
   a. If the compound is present in the blank but not present in the associated sample, no qualification of the data is required.
   b. If the compound is present in both the blank and the associated sample:
      i. If the sample result exceeds the detection limit but is less than 5 times the associated blank result, the uncorrected sample result is qualified as a non-detect.
      ii. If the sample result is less than the detection limit and is less than 5 times the associated blank result, the sample result is reported as undetected at the detection limit.
      iii. If the sample result exceeds the detection limit and is greater than 5 times the associated blank result, the sample result is considered a positive hit. There is no subtraction of the blank result from the sample result.

3. CALIBRATION.
   The required response factor control limits for the initial calibration is % RSD $\leq$ 30% and for the continuing calibration shall have a % D $\leq$ 25%.

   a. Initial Calibration.
      If % RSD > 30%, all positive results in samples associated with the calibration shall be qualified as estimated (J). All negative results shall be qualified as estimated detection limits (UJ).
   b. Continuing Calibration.
      If % D > 25%, all positive results are qualified as estimated (J) and all negative results are qualified as estimated detection limits (UJ).

4. SURROGATE SPIKE RECOVERY.
The required control limits for surrogate recovery is 75-125%.

   a. Surrogate recovery outside limits but > 10%.
      i. Positive results are qualified as estimated (J).
      ii. Negative results are qualified as estimated detection limits (UJ).
   b. Surrogate recovery < 10%.
      i. Positive results are qualified as estimated (J).
      ii. Negative results are qualified as unusable (R).
   c. Method or reagent blank outside limits.
      Qualify all associated results based upon a. or b. above depending upon the % recovery in the blank.

5. INTERNAL STANDARDS AREAS.
The internal standards area control limits in each sample are 50% to 200% compared to the associated calibration standard. If outside these limits, positive results are qualified as estimated (J) and negative results are qualified as estimated detection limits (UJ). If < 25%, all positive results are qualified as estimated (J) and all negative results qualified as unusable (R).

6. MATRIX SPIKE/MATRIX SPIKE DUPLICATE.
The recovery limits for each matrix spike compound is 80-120% and the relative percent difference (RPD) between the duplicate results shall be ± 20%. The only qualification of the data required when the results are outside the limits is to qualify the native unspiked sample results. All positive results shall be qualified as estimated (J) and all negative results shall be qualified as estimated detection limits (UJ). The reviewer shall attempt to determine the cause of the outlier performance.

7. QUALITATIVE IDENTIFICATION.
If the laboratory reports false positives (i.e. compound retention time exceeding ± 3 standard deviations), the associated results shall be qualified as unusable (R).

8. FIELD DUPLICATES.
No specific qualification of the field duplicate results shall be done except to calculate the percent difference in the results. Further evaluation shall be performed during data assessment.

9. MISCELLANEOUS.
The reviewer shall examine all chromatograms, spot-check calculations and verify that all data deliverables are included.